SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXV.—No. 2. ESTABLISHED 1845. NEW YORK, JULY 11, 1891. $3.00 A YEAR. WEEKLY.

IMPROVED METHODS OF BUILDING.

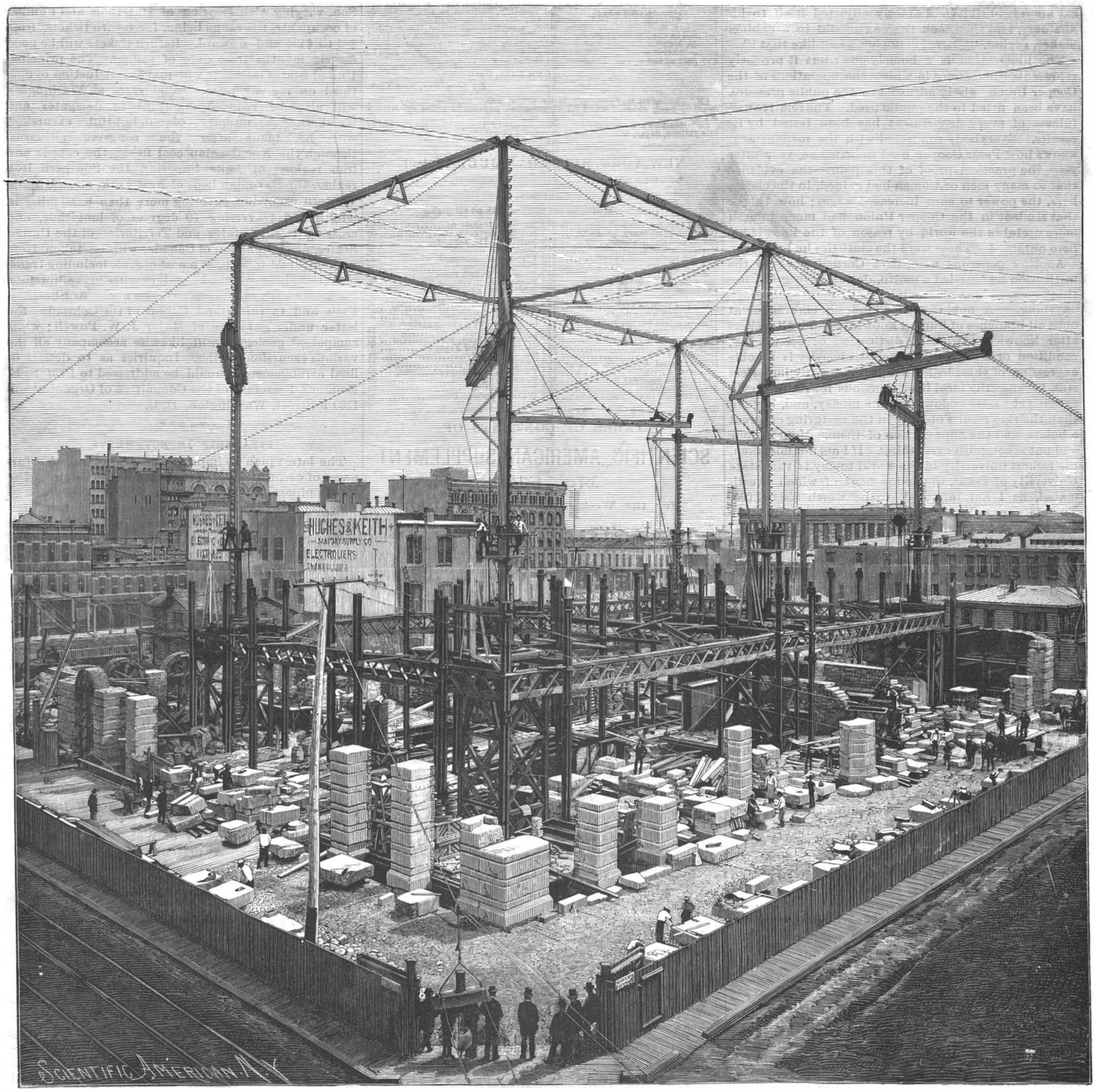
The Equitable Assurance Co., of New York, is erecting in Denver a building which is to cost $1,500,000, to be finished by April 1, 1892. It is designed for modern offices, is to be thoroughly fireproof, and will, when finished, be the finest and most costly building west of Chicago. This great work is being carried forward by the Denver Equitable Building Company, a corporation organized for this special purpose.

In carrying out such a work as this, the first question which presents itself is one of economy of labor. In addition to this, the shortness of the time which is allowed for the completion of the building has a modifying influence on the method of construction. The principal work in the erection of one of these monster buildings is the handling of the thousands of tons of materials which are required in its construction. In this case the building company, after due investigation, decided to employ the Norcross derrick for this purpose. Six of these derricks were erected upon the plot within the outer lines of the building, each having booms long enough to extend twenty-five feet beyond the walls on each side, the whole being capable of covering the entire plot. These derricks are mounted on heavy trestle work, which raises them forty-two feet above the cellar floor, and the booms are so high that it will be unnecessary to remove the derricks before the fifth story is reached.

The masts of the derricks are of Oregon pine, 16 inches square and 75 feet long, and the booms are composed of two pieces of Oregon pine, 16×18 and 52 feet long. The back straps are of Norway iron, 1×6 inches, and the iron suspension rods extending from the tops of the masts to the booms are of 2 inch round iron. The booms are each provided with a trolley by means of which the material may be carried in a horizontal direction. The derricks are turned by men who stand on platforms on the masts, who also operate the trolley by means of chain and worm gear.

The hoisting cables extend to the engine house, which contains six hoisting engines, one for each derrick, each engine being 40 horse power, with a capacity of 7,000 pounds on a single rope. An electric call bell and indicator is provided for each engine, so that the men at the derricks may communicate with the engineer by means of audible and visible signals.

The first work done by the construction company was to put down a 600 foot artesian well in the center of the plot, for the supply of water required for the engines, for building purposes, and for subsequent use. The first two stories of the building are to be of Colo-



THE GREAT DERRICKS OF THE NEW EQUITABLE BUILDING, DENVER, COL.

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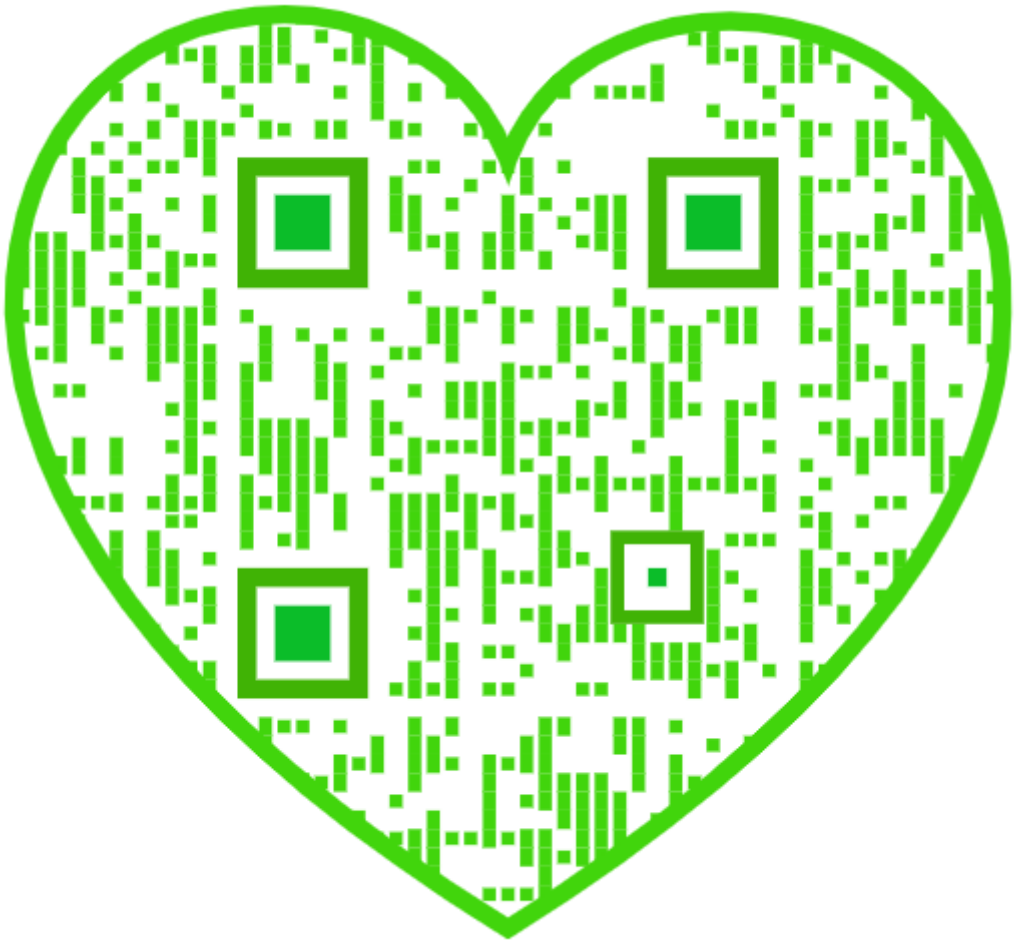

rado granite, the balance of Colorado brick. The interior will be constructed with steel beams and fireproof tile arches. The building, together with the plot (125×200 feet), will cost $1,880,000.

Messrs. Andrews, Jaques & Rantoul, of Boston and Denver, are the architects. The erection of the building is in charge of William M. Scanlon, manager of construction, and John S. Brisbrie, superintendent.

The Work of the Cooper Union.*

The Cooper Union of Science and Art was not founded for science or for art, but for man. And it has been steadily directed with that purpose in view. While, on the one hand, there has always been a regular course, through which students might pass, obtaining what we all desire, if we are so fortunate as to have the necessary time and opportunity—a systematic preparatory training, such as the graduates of to-night have enjoyed—the facilities of special departments of the Cooper Union have been enlarged from time to time, to suit the needs of the workingmen and workingwomen of New York, not as those needs are conceived according to some profound theory of what they ought to be, but as experience has proved what they actually are.

The great mathematician and wit, Professor De Morgan, of Oxford, praised in one of his essays (reprinted after his death in that quaint and charming book "A Budget of Paradoxes") the practical common sense and individuality of a rheumatic old gentleman, who, finding no ready-made chairs that fitted him, just spread on a board a mass of shoemaker's wax, then sat upon it until it had exactly adjusted itself to his anatomy, and then took the wax mould to a cabinet maker, saying, "There! make me a seat like that!"

The illustration is a homely one; but it precisely represents the manner in which the operations of the Cooper Union, wisely adjusted to the public pressure, have been fitted to the public need. The relative usefulness of every department has been tested by its results. Everybody connected with the management knows how Peter Cooper used to welcome, year after year, the practical proof of this point—the evidence that so many men or women had gained, in the classes here, the power to earn increased wages; how this or that student in the Cooper Union had made himself more useful in the world by reason of the knowledge here obtained. These were the statistics he loved.

Another generous man, Ezra Cornell, gave to the institution he founded a motto, declaring in substance that it was to be a place where "any man could learn anything." A noble charter, indeed, embracing at once all branches of human knowledge and all seekers after knowledge, without distinction of color, class, condition or sex. And Cornell University is a noble expression of this ideal—though necessarily imperfect still, because the ideal itself demands for its full realization yet vaster endowments in money, and, beyond that, the ripe results of time in the maturing of great scholars, and the appreciation of them. Money alone will not accomplish everything. If I am not mistaken, the richest university in the world to-day is the State University of Texas, the endowment of which is estimated, as I am informed, to be worth $50,000,000. That is a grand provision for the future; and the future is never far off in the United States of America.

But meanwhile, even for the sake of the future, we have to deal with the present, and the prime purpose of the Cooper Union was not to establish a superfluous rival to Columbia, or the University of New York, but to aid the working people of New York—the class which will always exist, no matter what great universities may hold above its head the culture to which only a small part of the community may aspire. Thus this institution stands to-day, a University of the People, the type and model of many others of its class; and my old friend and schoolmate, the President of Columbia, never occupied a more dignified or consistent position than when he stood upon this platform last February to praise the character of Peter Cooper, and the institution which Peter Cooper created.

The proof that the Cooper Union supplies a great want with a great relief is overwhelming. One branch of it—and one branch only—is seen in such gatherings as that which our alumni organized in February last, to celebrate the centennial of Peter Cooper's birth. How the testimony of that meeting would have rejoiced his heart. What could be more glorious and grateful to any man, either before the tribunal of history or at the higher tribunal of the judgment day, than the glad witness of thousands who have received from him the one gift that neither impoverishes the giver nor pauperizes the recipient—the gift of knowledge, which is power!

The Speed of Electricity.

It requires about three seconds to transmit an electrical signal through the Atlantic cable. The speed at which electricity travels amounts to several thousand miles per second, but the electrostatic resistance of the cable reduces this speed to about 1,000 miles per second.

*Abstract from the address of Dr. R. W. Raymond at the commencement of the Cooper Union, May 28, 1891.

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INTERNATIONAL CONGRESS OF GEOLOGISTS.

Official notice has been given of the approaching sessions of the Fifth Geological Congress in time to enable foreign delegates to arrange for their attendance. It has been wisely planned to have several important scientific bodies meet successively in the rooms of the Columbian University, Washington, D. C. From August 19th to 22d, there will be meetings of the sections and various allied societies of the American Association for the Advancement of Science, of which the foreign delegates will be honorary members. The Geological Society of America will be convened August 24th and 25th, in whose discussions foreign guests may also participate. The International Congress will be in session from August 26th to September 2d. The daily hours will be for the council, 10 A. M., and for the congress 11 A. M. and 2.30 P. M., with lectures, receptions, etc., in the evening. Besides the consideration of reports and other routine business, the following subjects will be made special topics for consideration:

1. Time correlation of the Clastic rocks by structural data, *e. g.*, stratigraphical, lithological, and physiographical; and correlation by paleontological data, *e. g.*, by fossil plants, and animals, marine and terrestrial.

2. General geological color schemes and other graphic conventions.

3. Genetic classification of the Pleistocene rocks.

Reduced rates on the Inman, Red Star, N. German Lloyd, and Netherlands-American lines of ocean steamers have been arranged for with Thos. Cook & Son, varying with location of stateroom and number of occupants, the range being, for return tickets, from $85 to $122 and upward. Return tickets will be good for six months from date of sailing. The principal United States railroads will make a reduction of one-third on regular rates. Hotel rates at Washington will also be reduced one-third to delegates and members. A number of delightful excursions will be made after the congress adjourns, through the Appalachian coal fields, the copper and iron regions of Lake Superior, the Southern iron region, the Devonian beds of New York, etc. A grand Western excursion, covering more than 6,000 miles in length, and traversing 39 degrees of longitude, and crossing twenty States and Territories of the United States, and a portion of Canada, will be taken from September 2d to 26th, at a cost of $265, including transportation, lodging, meals, and coaches in Yellowstone Park. Branch excursions will be made to Shoshone Falls and to the Grand Cañon of the Colorado—the latter under guidance of Major J. W. Powell; while competent geologists will likewise accompany all the various excursion parties. Inquiries as to details of final arrangements should be addressed to Prof. S. F. Emmons, Secretary of the Committee of Organization, 1330 F Street, Washington, D. C.

STEAMSHIP IMPROVEMENTS.

The latest plan to improve the draught of the furnaces of ocean steamers is to increase the height of the smoke pipes. The new steamer Scot, of the Cape Mail Line, is provided with smoke stacks 120 feet high above the grates, being the loftiest pipes ever put into a steamer. A draught of ¾ inch water pressure is thus obtained, all the steam needed is easily secured, and the use of fans is dispensed with. Her speed is 19 knots.

The Scot is 502 ft. long over all, 460 ft. on the water line, 54 ft. 6 in. beam, 37 ft. 6 in. deep. Tonnage 7,000. Built of steel. Fourteen watertight compartments. Draws 23 ft. with 2,800 tons of coal on board. Twin screws, 8,000 h. p. engines, two sets of triple expansion engines, 34½ in., 57½ in., 92 in. by 60 inch. Six double ended boilers, pressure 170 lb.; 36 furnaces. The success of the tall chimneys of the Scot will probably lead to the trial of even higher pipes. The above vessel could clear the floor of our Brooklyn bridge, which is 119 ft. above high water. If our great war steamers should be piped in accordance with the latest and best engineering practice, they will be debarred from the Brooklyn navy yard, unless they approach from the Hell Gate side of the great bridge. It was an error on the part of the Secretary of War to allow so low a floor for the bridge. At present all the larger ships are obliged to dismantle and lower their topmasts in order to pass under the Brooklyn bridge.

Pleuro-Pneumonia in England.

The outbreak of this disease in the herds of the East Riding and the action taken by the Agricultural Department have caused quite a stir among the agriculturists of Yorkshire. The number of animals ordered to be slaughtered is 170. The slaughter is expected to occupy ten days in all, and the value of the beasts destroyed and to be destroyed is estimated at fully $15,000, which will be paid by the Agricultural Department of the Privy Council. The outbreak of the malady, which is on a scale unprecedented in so small an area, will probably affect the cattle show of the Royal Agricultural Society at Doncaster.

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A Lake Formed in Colorado Desert.

This desert is in the eastern part of San Diego, the southern county of California, and is about two hundred miles directly south of what is known as Death Valley, on the boundary line between California and Nevada. The Southern Pacific Railroad runs through the Colorado Desert, on a northwest by southeast route, and its station at Salton, 90 miles from the Colorado River, marks the lowest level on the route, being 263 feet below the level of the sea, while for some thirty or fifty miles southeast of Salton the land is 250 feet below the sea level, the width of the portion having this great depression varying from five to twelve miles. In this tract, during the latter part of June, water began to appear, seeming at first to emanate from some unknown subterranean source, and by July 1 a lake some thirty miles long by twelve miles wide and two to three feet deep had been formed around and stretching to the southeast of Salton. It was soon discovered, however, that there was a strong current in the lake from the southeast, or the direction of the Colorado River. Several channels, ordinarily dry, lead from near the banks of this river to the desert basin, and it was soon apparent that the water came from the river, which is always at its highest stage late in June, as the result of the melting of the winter snow in the mountains of Colorado, Utah, and Nevada. This river, at Yuma, in the southeastern corner of the State, is 140 feet above sea level, and Major Powell, of the United States Geological Survey, places it as only a short time back, geologically, when the river emptied into the Gulf of California some two hundred miles north of its present mouth. The river carries an enormous amount of sand and silt, and is supposed to have built at its mouth a dam which cut off from the Gulf the large areas of country now included in the Colorado Desert and Death Valley region. The average rainfall here is only three inches a year, and, with the temperature as high as it is, evaporation proceeds very rapidly. It is thus that were left these great basins, the lowest land of the United States, and, as the evaporation here proceeds at the rate of 100 inches a year, it is not supposed that any quantity of water which may now be poured into the Colorado depression by the overflow of the river will cause more than temporary inconvenience.

Tons of Currency in Uncle Sam's Treasury.

The new treasurer of the United States has only recently finished counting out his money. It took some time, because it is no small job to reckon over 4,500 tons of coin; and this is apart from $300,000,000 or so in bank and treasury notes. For several weeks clerks were engaged in clinking the gold and silver which fill Uncle Sam's huge cash boxes, telling over the shining pieces, weighing them out and sealing them up in bags. One gets a notion of the magnitude of the task when it is considered that one of the vaults beneath the ground floor of the national treasure house, containing 85,000,000 silver dollars, is 100 feet long, 60 feet wide and 14 feet high—chock full of coined precious metal. As you walk around this huge lattice work box of iron and view its dimensions, you begin to realize the actual magnitude of so vast a sum. To empty the receptacle with a coal shovel would require many months of hard labor, if you had to do the work unaided. When the great French actress Rachel, who had always been very poor, was suddenly placed in possession of a large heap of gold coins, she put them into a basin and poured them over her bare arms delightedly, with ecstatic enjoyment of a literal wash in wealth. You might fairly swim in gold and silver in these immense coffers at the treasury. There is another which contains $25,000,000 in gold and $60,000,000 of silver also. In counting these masses of silver and gold, each bag containing $1,000 is removed from the vault and first examined to see if the seal is intact. If so, it is placed upon scales and weighed. On one side of the balance are put one thousand unused dollars, and the sack must be found an equal counterpoise. Supposing that it is light, it is opened and the money in it is reckoned piece by piece. Coin suffers more or less loss of weight by abrasion, even when not in circulation, and it might be that a bag would be less heavy on this account, though having in it the required $1,000. Also when a seal has been disturbed the contents of the sack are poured out, stacked up, counted and put back again. The sacks which are opened are resealed; but ordinarily the seals are found all right and the weight is correct, in which case the bags are computed as representing so many thousands, and no further trouble is taken with any of them before putting them back into the vaults. When the gold is gone over, a particularly rigid inspection is exercised by the overseeing officials, because the value is so much the greater. It is a very interesting sight to watch the millions in paper money—bank notes, treasury notes and gold and silver certificates—being counted by deft-fingered young women in a big room beneath the treasurer's office. Every dollar has to be numbered before the new guardian of the national cash box gives his receipt in full to the out-going incumbent. The stuff is all kept, save such small change as is needed to transact government business with, in the shape of packages, each about one foot cube, which are stored away on shelves in vaults. Cash in the shape of gold or silver takes up a great deal of room, but in bills enormous sums require very little space to hold them.

One of the vaults, which is nothing more than a big safe about as large as an extra size closet, alone contains $150,000,000. Each package holds four thousand notes, is done up in ordinary brown paper, and labeled on the outside in red figures with the amount inclosed. If it is a parcel of twenties, the bundle represents $80,000, if hundreds $400,000. Just such a package was made up a few years ago that held $40,000,000 in gold certificates of $10,000 each. You could carry one like it under your arm very comfortably. The packages of notes are brought down on little trucks by the elevator from upstairs and wheeled into the room where the counting is done. They are brought by the assistant cashier in person, and the committee in charge of the reckoning receipts for every bundle. Each parcel is opened in its turn and the contents handed over to one of the skilled young women, who is responsible for it, and signs a guarantee of its correctness before it leaves her hands. She runs over the crisp, unused bills with fingers marvelously rapid, taking note not only as to whether there are four thousand of them inclosed, but also regarding the numbers on the notes themselves, which must run in regular order. If there is a number wrong, her practiced eye detects it swiftly, or, if a bill is defective in its printing, she removes it, and it is sent back to the Bureau of Engraving and Printing, to be replaced with another.

When the bundle has thus been found correct, the notes are put under a hand press for a moment to reduce them to the least possible bulk, a new wrapper of brown paper is put around them, and a seal with red wax completes the operation, at the conclusion of which a memorandum is made of the sum the package contains, and it is ready to be sent back to the vaults with its fellows. At the close of the last count that was made of the money in the treasury the cash was found $19 short, but the amount was subsequently swept out of the corners of one of the vaults in the shape of some stray silver coins. It is said that no deficiency of this sort has ever occurred save once, when the specie turned over to a new treasurer proved to be just three cents short, and the outgoing official was obliged to make up the amount out of his own pocket.

If it should ever happen that an unexpected hole in the assets was made by an embezzlement or otherwise, the treasurer would be responsible, but Congress would undoubtedly make it up for him by a special appropriation. It is hardly likely that such a thing can occur, however, inasmuch as things at the treasury are so arranged that not even the treasurer himself can possibly steal a dollar, nor yet the secretary of the treasury, nor the register, nor the cashier, nor any one else, unless a conspiracy were organized. Furthermore, if anybody succeeded in breaking in from the outside, he could not very well get away with more than two hundred pounds of gold, which only represents about $50,000. A million dollars' worth of that metal weighs one ton. This would be discouraging.

Not long ago there were certain treasures of considerable value in the treasury, in the shape of articles made of gold and silver and precious stones, which had to be looked over and receipted for, as well as the money. Most of these things were presents which had been made to the various Presidents of the United States and to other officers of the government by foreign powers and potentates, and which they could not accept on account of the existing law forbidding reception of such favors. Among them was a bottle of attar of roses, given to President Grant by the imaum of Muscat, which held a pint of this valuable fluid, also a bottle of pearls, another bottle of diamonds, a gold sword scabbard, a diamond snuff box, ten beautiful sabers from Ali Pacha, bey of Egypt, and lots of other such trifles.

In old times the Patent Office was a sort of museum of curiosities, and these gifts and other valuables were deposited there. A large part of them were stolen twice, and on the occasion of the second robbery the thieves got away with pretty nearly all of them that were worth taking. They secured the bottle of pearls and the bottle of diamonds, as well as the diamond snuff box, the scabbard of the gold sword and a number of medals. Not even the pint bottle of attar of roses did they leave behind. This disaster occurred on the night of November 9, 1848, and on the following day a reward of $1,500 was offered for the capture of the goods and the burglars. The latter were traced to New York, where the treasures were recovered, although the precious articles of gold and silver had been melted down, after removing the gems with which they were set, for pawning separately. Later on it was thought desirable to hand over the whole business to the care of the treasury, which was done in 1883. The collection remained in its hands for some years, until a while ago it was turned over to the National Museum. There were some curiosities among these valuables which are rather difficult to account for—for example, two Rio de la Plata dollars, a shotgun with gold mountings, seven gold coins from ancient Rome, a pair of pistols, and a pearl necklace. There were ever so many medals of all sorts, in gold and silver. One box there was full of diamonds and pearls, which had been presented by the emperor of Japan to President Monroe. The gems were not of the very finest kind, being intended for the decoration of sword hilts and purposes of that sort, but nevertheless they were worth a good deal of money.

For years that box of jewels gave great annoyance to the officials at the treasury. Every time there was a count of the assets of that institution, President Monroe's casket would turn up, and eager Washington correspondents, with noses preternaturally alert for news, would send out all over the country reports of the discovery in an odd corner of an unswept vault of a box full of precious stones belonging to the family of Mr. Monroe. Whereupon, editorials would appear in papers opposed to the administration, condemning this neglect and demanding that the treasure be turned over to the indigent descendants of the author of the famous doctrine. Between whiles charges would be printed to the effect that the pearls and diamonds in question, having been unheard of for some time, had presumably been distributed among the heelers of the wicked party in power.

Congress never passed an act permitting Mr. Monroe to accept the gift in question, and so it was transferred to the National Museum, together with the rest. There were other valuables also given into the hands of the treasury which were captured and confiscated during the war. Among them were 240 watches, eighty-five chains, eleven rings, six lockets, one bracelet and one pair of compasses. Most of these were secured at one haul from the person of a Southern banker, with whom they had been deposited for safe keeping. He fled with them on his person, and was so unfortunate as to be caught. For a long time there were large stories current of the wealth in the possession of the government got during the rebellion.

It was told how the ladies of Richmond, inspired by noble and patriotic motives, turned their jewels, watches and money into the Confederate treasury, piling up a vast amount of value there, and how the "swag," as vulgar burglars phrase it, was gobbled by the Union forces. But the fact was that the latter found no treasures of any sort to gobble in Richmond, and the heaps of riches in cash and collateral referred to were all imaginary.

* *American Analyst.*

Antiquity of the Electric Light.

Those who suppose the electric light to be a production of the present decade will be able to correct their apprehension of the subject after reading the following item:

[From the SCIENTIFIC AMERICAN, December 9, 1848.]

"NEW ELECTRICAL LIGHT.

"The inventors of a new electrical light, exhibited at the Western Literary Institution, Leicester Square, London, on its recent reopening under the new auspices, expect, it is said, to apply it generally to shop and street illumination, and they state that while the conveying will cost no more than gas, the expense of illumination will be one-twelfth the price of the latter light. The current of electricity in passing through the two pieces of charcoal which form the poles of the circuit, and are excluded from all access of air, gives, in this case, it is said, an intense and beautiful white light, with the effect of daylight to a much greater extent than the lime does, and having this advantage, that it is sustained and continuous. If Messrs. Staite & Petrie can thus produce a steady and sustained light they have accomplished what has hitherto been the sole preventive to the substitution of galvanism for gas. The *Mechanics' Magazine* states that this one light completely eclipsed ten gas lights and an oxyhydrogen. The gas companies had better look out. The dissatisfaction of the public with their mismanagement may have begotten a rival destined to eclipse many more than merely ten of their gas lights."

Dr. John I. Northrop.

By the explosion of alcohol in the storeroom of the Columbia College School of Mines, on the afternoon of June 25, Dr. John I. Northrop was burned from head to foot, his death following at the Presbyterian Hospital on the following morning. Dr. Northrop, who was an instructor in the college, had gone to the storeroom to fill a demijohn for use in his zoological laboratory. The room is a small, close, unventilated apartment, in which there was one barrel full and another partly full of alcohol, and it is said that the doctor struck a match in the room, causing the explosion which cost him his life.

Dr. Northrop was born in New York City, October 12, 1861, and was graduated from the School of Mines in 1884. He had recently received a year's leave of absence from his duties as an instructor in zoology, and was to start for Europe in a few days to study in the German universities.

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Immense Pecuniary Losses Occasioned by Insects.

A recent number of *Insect Life* says:

No very recent estimates of the loss arising from insect ravages have been made, but some of the older estimates are here given. Twenty-five years ago B. D. Walsh, the entomologist of Illinois, estimated the loss from this source at from $200,000,000 to $300,000,000 per annum. The great increase in acreage of crops and orchards since that date has been attended, of course, with a corresponding increase in destructiveness; but methods of prevention and remedies have so multiplied and improved that the ratio of loss has greatly decreased. Fitch, then New York State entomologist, estimated the damage to the wheat crop of that State in the year 1854 by the wheat midge at $15,000,000. The loss to wheat and corn on account of the ravages of the chinch bug in the State of Illinois alone in 1867 was estimated at $73,000,000. The loss occasioned in 1874 to corn, vegetables, and other crops by the Rocky Mountain locust in the States of Kansas, Nebraska, Iowa, and Missouri was estimated by Riley, from carefully collected data, at $100,000,000, to say nothing of the indirect loss by stoppage of business and other enterprises, which would probably increase the total loss to the neighborhood of about $200,000,000. The ravages in the principal cotton States of the cotton worm have amounted to a loss of about $30,000,000 in years of great abundance, while for many years the average annual loss was not less than 15 millions. A more recent estimate than those given may be mentioned.

The damage occasioned by the chinch bug in the year 1887 was estimated in the annual report of the Agricultural Department for that year at not less than $60,000,000. Dr. Riley has in fact repeatedly published the general estimate that the average annual loss to the United States from injurious insects exceeds $300,000,000.

The investigations of the United States Entomological Commission and of the Division of Entomology, Department of Agriculture, and also of State Experiment Station entomologists and private workers, have led to the discovery of remedies and preventives which, properly and thoroughly applied, result in saving a large percentage of the loss occasioned by insects, and the statement that these investigations have paid for themselves many thousandfold is indubitably true.

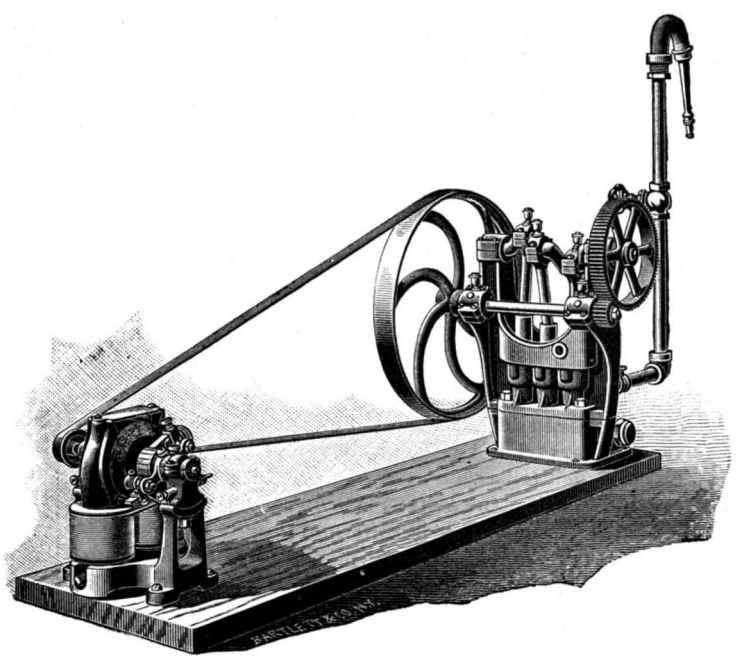
We may add that if the general government and the State goverments were to spend fifty times more money than is now granted for investigations respecting the habits of insects and the modes of destroying those that are noxious, it would, doubtless, be of great advantage to the country.

ELECTRICAL PUMP.

Naturally, along with the general adoption of electric lighting, there comes the use of a current for motive power for all kinds of industries, and for use outside of what are properly called industries in which manual power is displaced by electric motors. Prominent among these is the pumping of water in dwellings and other buildings in cities and villages where this work has usually been performed by hand. Electricity lends itself to this use in a peculiarly efficient manner, as it is perfectly automatic in its action, setting about its work when the tank becomes empty and stopping as soon as it is filled.

The motor shown in the annexed engraving is the smallest made for the purpose of pumping, by the Thomson-Houston Motor Company, of 620 Atlantic Avenue, Boston, Mass. It is a $\frac{1}{6}$ h. p. electric motor, connected by a belt with a $1\frac{1}{4} \times 2$ inch Gould triplex pump. Connected with this outfit is an automatic slow-acting switch, for stopping the motor as the water in the tank reaches its full height, and starting it again just before the tank is emptied. This pumping outfit has a capacity of 100 gallons an hour raised to a height of 30 feet. The next size, a $\frac{1}{4}$ h. p., with a $1\frac{3}{4} \times 2\frac{1}{2}$ inch Gould triplex pump, has a capacity of 250 gallons an hour raised to the same height. The number of gallons delivered varies inversely as the height to which the water is raised.

This company furnishes pumping outfits of any desired capacity and for any pressure. In the larger sizes, beginning with the 4×4 pump run by a $1\frac{1}{2}$ power Thomson-Houston motor, the pump and motor are placed upon the same base and connected directly by gearing.

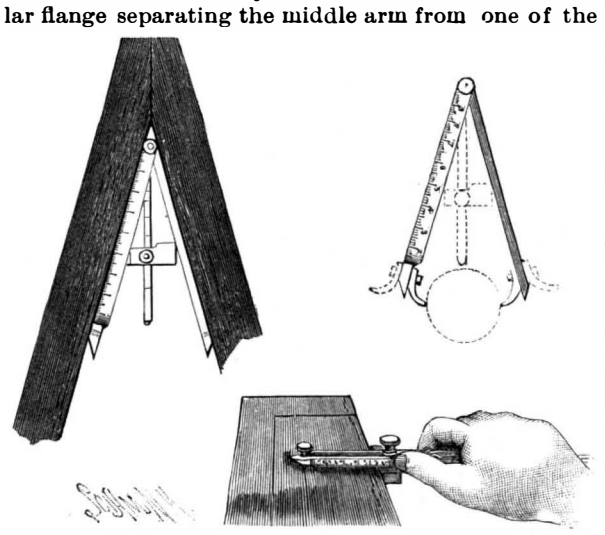


THOMSON-HOUSTON ELECTRIC PUMP.

ACCORDING to the authors, rape oil consists of the glycerides of three distinct fatty acids, one of which, melting at 75°, occurs only in very small quantities. The other two, erucic acid and a liquid acid which the authors name rapinic acid, are present in equal quantities. Lead erucate is readily soluble in hot ether. The zinc salts of the fatty acids can be separated by means of ether.—*Reimer and Will, Deutsch. Chem. Gesell.*

A MEASURING AND DRAWING IMPLEMENT.

The illustration represents an implement which can be readily manipulated to measure inside or outside angles and obtain their miters, or used for calipering, or as a depth and end marking gauge, dividers, compasses, etc. One view shows the implement as applied to take an inside angle and its miter, while in another it is arranged as a pair of calipers, the third view showing its application as a marking gauge. Three arms are jointed at a common pivot, the middle arm carrying an adjustable block adapted to engage the other two arms. The pivot has in its center an annular flange separating the middle arm from one of the side arms, the other arm being forked, and the outer ends of the forks hung on the pivot, which is threaded near its ends and engaged by nuts, by the adjusting of which the jointed ends of the arms are pressed upon to lock the arms in position. On the middle arm is fitted to slide a block, held in place by a set screw, the block indicating on a graduation representing degrees and subdivisions of angles measured by the outer edges of the other arms. The side arms have points at their lower ends, so that by removing the block from the middle arm and folding the latter into the forked arm the device can be used as a pair of dividers, in one leg of which a pencil may be fastened when it is to be used as a compass. In the outer ends of the main arms, also, at or near the points, are threaded apertures in which may be fastened curved finger pieces, fitting the device for use for inside or outside calipers. In adapting the device for a marking gauge, the forked arm only is used in connection with the block and set screw, a pointed screw then screwing in the threaded aperture near the end of the arm.



JAMES' MEASURING AND DRAWING TOOL.

This improvement has been patented by Mr. Charles W. James, of No. 4140 Parrish Street, West Philadelphia, Pa.

Progress in Military Ballooning.

There can be no doubt that balloons are destined to play an important part in the great European war which every one assigns to a more or less indefinite future. As a means of observing the movements of the enemy, and at times of enabling messengers or others to escape, they must have high value. The question is receiving at least as much attention on the Continent as in this country, and it is claimed that important advances have been made in the portability and simplicity of balloon equipments. There are large works near the Champ de Mars, Paris, which are entirely occupied in the construction of balloons and aerostatic machinery and material. Plants have been supplied to almost every foreign government, and complete schools of military aerostation have been fitted up in Italy, and more recently in Russia. The system employed in this balloon may be called the portable captive, and its adaptability to the conditions of actual warfare has recently been tested by the Italians in their campaign around Massowah. The total weight of all the plant necessary for the transport and inflation of the latest type of portable captive balloon does not exceed six or seven tons, so that it can easily be forwarded over long distances by rail. It is carried upon three wagons of special construction adapted to rapid conveyance over rough ground.

The entire equipment, besides the balloon itself, consists of an apparatus for the generation of the gas and a winding drum for the cable by which the balloon is secured. The generator produces hydrogen gas by the decomposition of water, and is of rapid and continuous action, supplying from 8,750 to 10,500 cubic feet of gas per hour. It can be set to work anywhere where there is a supply of water, such as is afforded by the proximity of a river or pond. The winding drum is worked by steam, and it unrolls not only the cable, which is over a quarter of a mile long, but also a telephonic wire, through which constant communication can be maintained with the occupants of the car. The capacity of the balloon varies from 17,500 to 21,000 cubic feet, and by an automatic arrangement the car is always maintained in a perfectly vertical line, notwithstanding the inclination of the cable. The makers of these equipments have at present under construction the largest balloon that has ever been constructed. The enormous captive balloon which made continuous ascents at the Paris Exhibition two years ago was of 105,000 cubic feet capacity, and carried twelve persons. The one now being made will be over 2,000,000 cubic feet, will be able to accommodate no fewer than 180 passengers, will have a car 35 feet in diameter, and will be held by a cable nearly 1,200 yards long.

But the most extraordinary product of the works referred to is a mysterious invention known as an "aerial torpedo boat," which has been ordered by the Russian government. All that is known about it is that it is an elongated balloon, 170 feet long, furnished with a steam engine of 50 horse power, and impelled at a speed of 25 miles an hour by a screw 36 feet in diameter. This is evidently the latest development of the familiar "flying machine" notion. The trials are to be conducted in secret at St. Petersburg. It is to be hoped that the Russian government will not have reason to regret its expenditure; but it is of ominous augury that nothing further has been heard of the trials that the French government commenced last year at Havre with another vessel of a similar design.—*The Engineer.*

The Pike's Peak Railroad.

Our Colorado correspondent writes from Manitou, Col., at the foot of Pike's Peak, June 28, 1891, that the date of the opening of the new road to passenger transportation to the summit of Pike's Peak, heretofore so frequently and erroneously stated, seems at last truly at hand.

A small army of Italians are to-day shoveling snow at or near the top, at an elevation of over fourteen thousand feet above sea level, and a large force of mechanics are at work adjusting the track, hurriedly laid last summer and somewhat disarranged by last winter's frosts.

The rack rails were found quite uneven, failing to accurately fit the cogs on the engines, causing unnecessary friction, necessitating an excessive consumption of steam and fuel, and making travel rough, noisy, unpleasant and expensive.

All the old cog wheels on the engines have been removed and new and heavier ones substituted, made of a tough and elastic steel, that will spring about sixteen per cent without breaking, obviating all danger should a tooth accidentally fail.

These cogs have now been gauged to within a sixtieth of an inch for the correct distance, so that a ton of coal, formerly consumed in a distance of three miles, now lasts the entire trip.

Cement for Parchment Paper.

The best cement for pasting parchment paper, according to a lithographic authority, is casein glue. It is much better than so-called chrome glue, because the latter produces yellow or brownish spots where it has been employed. Casein glue is a solution of casein, which appears as whey or drop when milk is allowed to curdle. The glue is dissolved in a saturated solution of borax. When dried in the form of transparent gelatin it appears as grayish white and somewhat brittle matter, which can be easily dissolved in water, and possesses great adhesiveness. When employed for pasting parchment paper a thin paste is prepared, used in the customary manner, and the jointed places afterward exposed for a little while to a jet of steam.

THE largest bay in the world is Hudson Bay, measuring 850 miles north and south by 600 miles wide.

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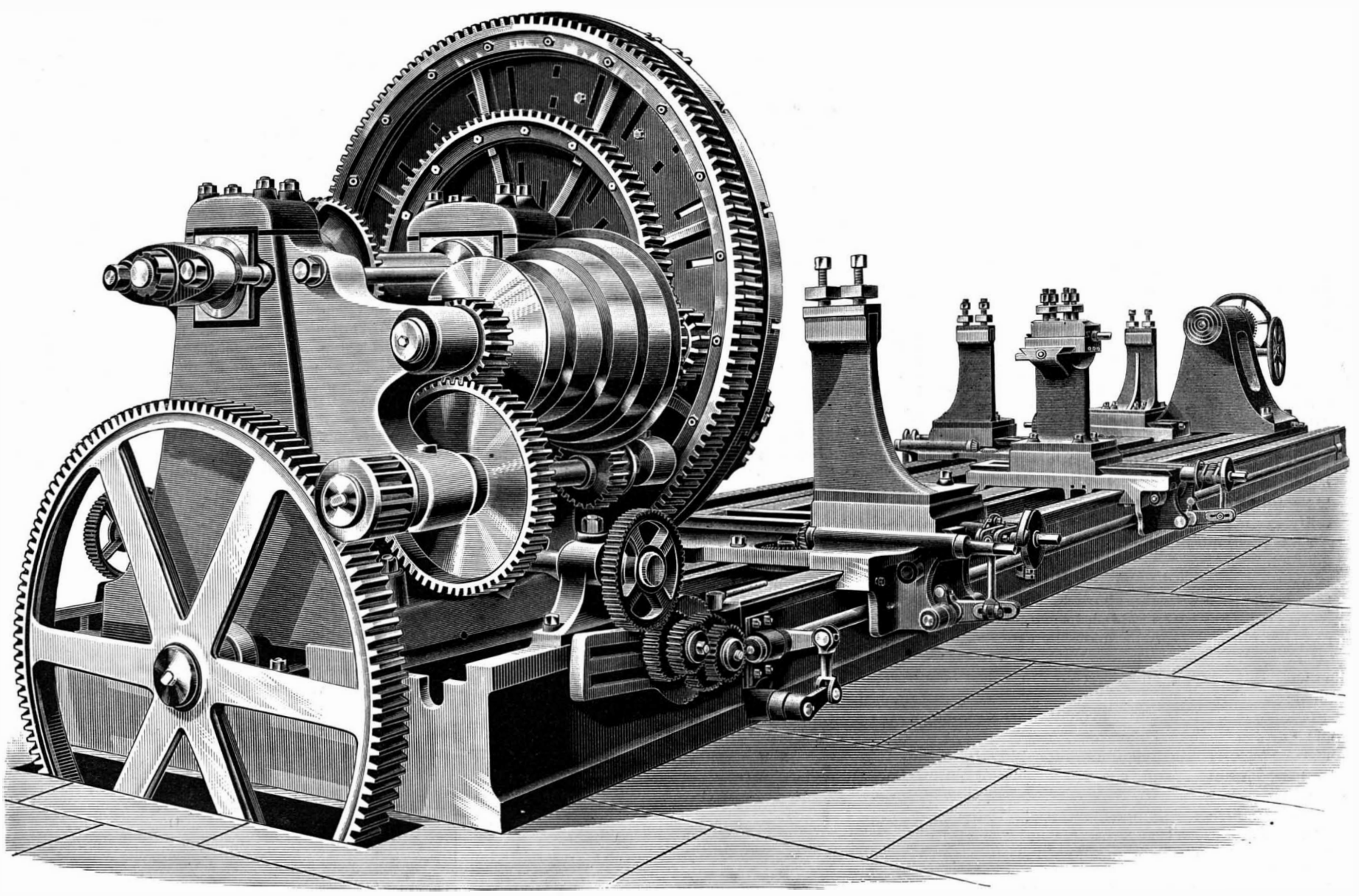
IMPROVED SLIDE AND SCREW-CUTTING LATHE.

This powerful lathe was recently made by Sharp, Stewart & Co., Atlas Works, Glasgow. The height of centers is 5 ft., and it admits between centers a length of 50 ft. 6 in., and the net weight complete is about 120 tons. The fast headstock has a steel spindle running in gun metal parallel steps, and the driving power is arranged with two series of triple gear for large diameters, as well as quicker speeds for ordinary work. The face plate is 10 ft. diameter, and is fitted as a four-jaw chuck, with hardened steel jaws. The loose headstock is of very powerful design, and, in view of the heavy pieces swung between the centers, the spindle has a "special" adjustment by a worm and wheel, as well as a quicker movement for bringing the spindle into position before the weight is upon it. The beds are of double form, and of very massive construction. There are four saddles, three being provided with a special rest for dealing with crank shafts, and one has a compound slide rest, with a swivel for taper work, this being interchangeable with the others. There are two guide screws, independently driven, for actuating the saddles, and the feed motion to each saddle is also independent. The two front saddles have an auxiliary feed—besides the ordinary one—for grooving cranks and cutting off the ends of steel ingots. Throughout, this lathe is of the most powerful character, and is capable of taking the heaviest cuts in steel.—*The Engineer.*



IMPROVED SLIDE AND SCREW-CUTTING LATHE.

Gems of the United States.

Mr. G. F. Kunz of this city has been exploring this field, and has collected information on the production of precious stones, more valuable because more thorough than has previously been done, from which we quote the following:

Turquoise, which was worked by the Aztecs before the advent of the Spaniards and since then by the Pueblo Indians, and largely used by them for ornament and as an article of exchange, is now systematically mined near Los Cerrillos, N. M. Its color is blue, and its hardness is fully equal to that of the Persian, or slightly greater, owing to impurities, but it lacks the softness of color belonging to the Persian turquoise. From time immemorial this material has been rudely mined by the Indians. Their method is to pour cold water on the rocks after previously heating them by fires built against them. This process generally deteriorates the color of the stone to some extent, tending to change it to a green. The Indians barter turquoise with the Navajo, Apache, Zuni, San Felipe, and other New Mexican tribes for their baskets, blankets, silver ornaments, and ponies.

The finest garnets and nearly all the peridots found in the United States are obtained in the Navajo Nation, in the northwestern part of Mexico and the northeastern part of Arizona, where they are collected from ant hills and scorpion nests by Indians and by the soldiers stationed at adjacent forts. Generally these gems are traded for stores to the merchants at Gallup, Fort Defiance, and Fort Wingate, who in turn send them to large cities in the East in parcels weighing from half an ounce to thirty or forty pounds each. These garnets, which are locally known as Arizona and New Mexico rubies, are the finest in the world, rivaling those from the Cape of Good Hope. Fine gems, weighing from two to three carats each and upward when cut, are not uncommon. The peridots found associated with garnets are generally four or five times as large, and from their pitted and irregular appearance have been called "Job's tears." They can be cut into gems weighing three or four carats each, but do not approach those from the Levant either in size or color.

In Arkansas, especially in Garland and Montgomery Counties, rock crystals are found lining cavities of variable size, and in one instance thirty tons of crystals were found in a single cavity. These crystals are mined by the farmers in their spare time and sold in the streets of Hot Springs, their value amounting to some $10,000 annually. Several thousand dollars' worth were cut from quartz into charms and faceted stones, although ten times that amount of paste or imitation diamonds are sold as Arkansas crystals.

The well known agatized and jasperized wood of Arizona is so much richer in color than that obtained from any other known locality that, since the problem of cutting and polishing the large sections used for table tops and other ornamental purposes was solved, fully $50,000 worth of the rough material has been gathered, and over $100,000 worth of it has been cut and polished. This wood, which was a very prominent feature of the Paris Exposition, promises to become one of our richest ornamental materials.

Of the corundum gems (sapphire, ruby, and other colored varieties) no sapphires of fine blue color and no rubies of fine red color have been found. The only locality which has been at all prolific is the placer ground between Ruby and El Dorado bars, on the Missouri River, sixteen miles east of Helena, Mont. Here sapphires are found in glacial auriferous gravels while sluicing for gold, and until now have been considered only a by-product. Up to the present time they have never been systematically mined. In 1889 one company took the option on 4,000 acres of the river banks, and several smaller companies have since been formed with a view of mining for these gems alone or in connection with gold. The colors of the gems obtained, although beautiful and interesting, are not the standard blue or red shades generally demanded by the public.

A very limited number of diamonds has been found in this country. They are met with in well defined districts of California, North Carolina, Georgia, and recently Wisconsin, but up to the present time the discoveries have been rare and purely accidental.

Chlorastrolite in pebbles is principally found on the inside and outside shores of Rock Harbor, a harbor about eight miles in length on the east end of Isle Royale, Lake Superior, where they occur from the size of a pin head to, rarely, the size of a pigeon's egg. When larger than a pea they frequently are very poor in form or are hollow in fact, and unfit for cutting into gems. They are collected in a desultory manner, and are sold by jewelers of Duluth, Petoskey, and other cities, principally to visitors. The annual sale ranges from $200 to $1,000.

Thomsonite in pebbles occurs with the chlorastrolite at Isle Royale, but finer stones are found on the beach at Grand Marais, Cook County, Minn. Like the chlorastrolites, they result from the weathering of the amygdaloid rock, in which they occur as small nodules, and in the same manner are sold by jewelers in the cities bordering on Lake Superior to the extent of $200 to $1,000 worth annually.

At New Milford, Conn., a property was extensively worked from October, 1885, to May, 1886, for mica and beryl. The beryls were yellow, green, blue, and white in color, the former being sold under the name of "golden beryl." No work has been done at the mine since then. In 1886 and 1887 there were about 4,000 stones cut and sold for some $15,000, the cutting of which cost about $3,000. The production of precious stones in this country in 1889 amounted to $188,000.

An Important Tunnel.

The greatest engineering feat in the history of the anthracite coal mining is about to begin. It is the commencement of what will be known as the Jeddo Tunnel, which will be driven for the purpose of draining the flooded mines of Jeddo and Harleigh. It will be constructed from Butler Valley, Pa., to the bottom of Ebervade mammoth vein, a distance of three miles, through solid rock, to be 8 feet square in the clear. The scheme of tunneling through the mountain first occurred to John Markle, who is to be president of the company, which will bear the title of Jeddo Tunnel Co., Limited. It will open an inexhaustible supply of coal and furnish employment for thousands of people for many years to come. It will also serve the double purpose of draining all the collieries in the valley.

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Writing Inks.

Writing inks can be made equally well from galls and tannin, but inks made from galls are preferable for copying purposes, as they have much greater "body," owing to the extractive matter derived from the galls. The following formulæ are taken from notes by Dieterich quoted by the *Pharmaceutische Centralhalle*. The peculiarity of the first set of formulæ is that they start from the extract of galls and solution of tannin, to which, after filtration, a definite amount of ferric-chloride solution is added, and, after standing three weeks, these ferrated solutions are filtered. We shall call these ferrated solutions "gall basis" and "tannin basis" respectively. They really are the ink, but it is necessary to add coloring matter in order to make the writing visible. On exposure to the air, the writing becomes black. Chinese galls are preferable to oak galls for ink making, as they contain most extractive matter. To make the

GALL EXTRACT,

reduce 6 oz. of Chinese galls to No. 20 powder, and digest in a pint of water for twelve hours. Strain, press the marc, and digest it again in 12 ounces of water for twelve hours, repeating the pressure at the end of this time. Now add to the strained liquors 5 drachms of powdered French chalk. Set aside in a cold place for twenty-four hours, then filter, washing the filter with as much water as will make the filter measure 30 ounces.

TANNIN SOLUTION.

This is made by dissolving 3 ounces of commercial tannin (it need not be the purified medicinal kind) in sufficient water to make 30 ounces of solution.

GALL BASIS.

To 10 ounces of the gall extract add 1 ounce of 10 per cent solution of ferric chloride, made by dissolving the salt in distilled water. Allow the mixture to stand in a corked bottle for three weeks and filter.

TANNIN BASIS.

Made in the same way, using 10 ounces of the tannin solution and 1 ounce of iron solution.

BLUE-BLACK OFFICE INK.

Gum arabic	½ ounce.
Aniline water-blue, I.B.	75 grains.
Glycerine	1 fl. drachm.
Water	12½ ounces.

Mix these with 18 ounces of gall basis or the same of tannin basis, and set aside in a closed vessel for a few weeks to clear. Then fill into small bottles, preferably stone bottles, so as to keep away from the light.

This ink writes a beautiful blue color, dries very readily on the paper, and changes to a good blue-black. It is of good quality, and is well liked. It is not a copying ink.

A RED-BLACK INK,

which is identical with the above in quality only that it writes red, changes to reddish-brown, and finally to a deep brown-black, can be made by using 150 grains of Ponceau BB. (a red aniline color) in place of the aniline water-blue. The following colors may also be obtained:

Violet-black.—Mix together 2 parts of the red-black and 3 parts of the blue-black inks.

Green-black.—Omit the aniline water-blue from the blue-black formula, and use 150 grains of aniline green D.

Blue green-black.—Mix together 2 parts of blue-black and 3 parts of green-black. A nice color is also obtained by adding 8 to 15 grains of aniline green to the blue-black ink.

Deep-black.—Omit the aniline water-blue, and use in its place 5 drachms of aniline deep-black E.

COPYING INKS.

The following are made with the same bases as the foregoing:

King's Copying Ink.

Gall basis	24 ounces.
Aniline water-blue, I.B.	150 grains.
Glycerine	2 fl. drachms.
Gum arabic	5 drachms.
Sugar	150 grains.
Water	8 ounces.

Mix and set aside for a few weeks as above directed.

A ruby ink is made by using 150 grains of Ponceau R.R. in place of the aniline water-blue. Both the inks and the copies ultimately turn jet-black. Other colors are obtained with aniline green D, 150 grains; deep-black E, 5 drachms; and indigo-carmine, 150 grains each, in place of the aniline blue.

INK EXTRACTS.

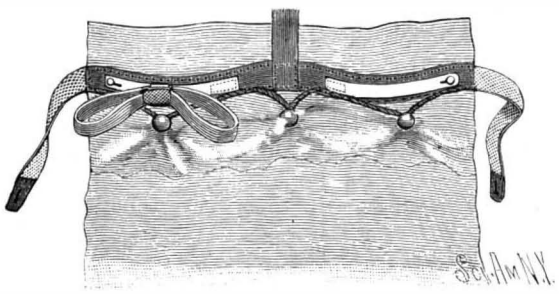
The following quantities are intended for a wine-bottleful of rain water. The powder is to be added to the water, and the mixture gently boiled for from fifteen to twenty minutes, and when cold the ink should be bottled and set aside for four weeks before using:

	Plain.	Copying.
Tannin	1 ounce.	9 drachms.
Dried sulphate of iron	3½ drachms.	4 "
Gum arabic	75 grains.	2 "
Sugar	40 "	75 grains.
Aniline water-blue, I.B.	40 "	75 "

Other colors may take the place of the aniline blue as in the preceding formulæ.

A BEDCLOTHES FASTENER.

The illustration represents a device more particularly designed to prevent children from becoming uncovered when sleeping in bed, at the same time stopping them from lying on their backs, and thus preventing nightmare and snoring. A band is arranged to extend across and be attached at or near its ends and middle to the upper end of the under side of the top sheet or cover. The attachment is made by cords fastened to the band and secured by a whip grip around balls of rubber, cork, or wood, incased by the sheet. To each end of the main band are attached elastic extensions, to be secured by eye-holes on screw-hooks on the side of the bedstead, a branch band also extending to a similar fastening on the head of the bedstead, there being more than one branch band if more than



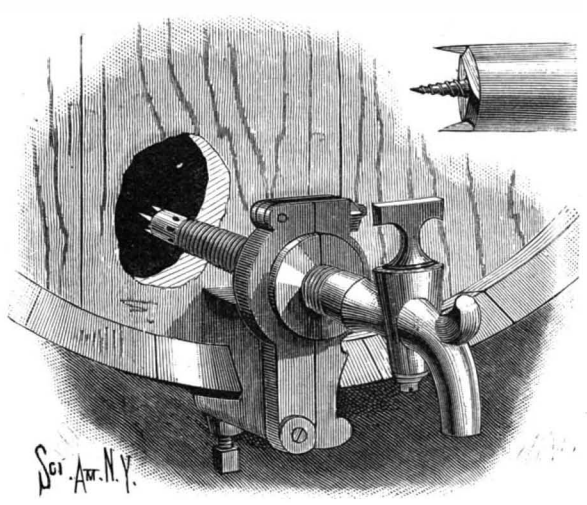
ANGELL'S BEDCLOTHES FASTENER.

two persons sleep in the same bed. Upon the under side of the transverse loop-like body band are band slides on which slide loops, to each of which is attached a double shoulder strap, adapted to fit comfortably over the shoulders of a child or other person, and partly made up of elastic webbing. This strap is intended to allow sufficient freedom of the limbs and body, but prevent one having it on lying on the back. The shoulder strap is put on the child before the latter is put to bed, and is then attached to the slide.

Further information relative to this invention may be obtained of the patentee, Mr. C. E. Angell, Box 75, Salt Lake City, Utah.

A DEVICE FOR TAPPING BARRELS.

A novel form of faucet and attachment, by means of which the faucet may be made to form its own opening into a barrel at any desired place, is shown in the accompanying illustration, and has been patented by Mr. William Lindenmann, of No. 93 Gilden Street, New Brunswick, N. J. A frame or block, having an angular recess adapted to engage one of the staves of the barrel head, is secured to the barrel by a set screw. On the frame is an upwardly extending arm carrying a pivot pin, on which is pivoted a second arm adapted to close on the first arm, and be fastened thereto by a pivoted bolt passing through slots in both arms at their upper ends, a nut screwing on the end of the bolt to clamp the arms together. The two arms are adapted to hold in place a sectional nut, of polygonal shape on its inside, and fitting in correspondingly shaped recesses in the arms, thus preventing the nut from turning. This nut is adapted to be engaged by a screw thread on the shank of a faucet, which has its rear end formed into an auger adapted to screw into the head of a barrel. Openings are formed in the shank in the rear of the



LINDENMANN'S FAUCET.

auger, so that when the latter has passed through the head of the barrel communication will be established between the interior of the barrel and the bore in the shank of the faucet.

THE Shepherd Sewerage System Co., of N.Y., whose automatic valve has been patented in this country and Europe, have recently established a branch office at 109 East Fayette Street, Baltimore, Md. This invention has been tested in this city and elsewhere.

In this system a valve is used which is claimed to be proof against clogging and which will automatically and periodically discharge the contents of the lower end of the drain pipe into the sewer, at the same time cutting off the gases from flowing back into the house.

The New French Steamship La Touraine.

This, the first twin screw vessel of the French line, arrived in New York from Havre on her maiden trip on June 26, covering 3,177 miles, by a long southerly route. Her average hourly speed was 18·41 knots, and her daily runs were: 507, 450, 451, 442, 456, 481, and 390 knots. Her furnaces burned 240 tons of coal a day, and her propellers made 74 to 75 revolutions a minute. Her engines developed 12,000 horse power, or 1,000 less than her maximum capacity, although forced draught was used throughout the voyage.

La Touraine was built by the Compagnie Generale Transatlantique, in their own ship yards at Penhouet, near St. Nazaire, France. Her keel was laid more than two years ago, so that ample time has been taken in her building. She is 540 feet in length, 57 feet in width, and has a depth of hold of 38 feet. Her burden is 11,675 tons. At the trial trip before the French commissioners the minimum speed attained was 19½ knots. This rate was increased to 20½ when the ventilators of the engines were in operation. During her passage from St. Nazaire to Havre the steamer made the distance between the two ports in 20 hours and 30 minutes, which gives a speed superior to 21 knots.

She has two triple expansion engines of 11,000 horse power, nominal, and can, it is said, easily be brought up to 13,000 each. The engines are separated by a longitudinal water tight bulkhead, and each engine normally operates but one of the two screws. The vessel has all the latest improvements in marine construction and is divided into fourteen water tight bulkheads, which form a safeguard against sinking in case of accident or collision.

There are 36 special cabins, 6 of which contain large double bedsteads, bathrooms, and wardrobes, 8 cabins with 2 beds each, 4 cabins for a single person, 15 for 2, and 3 for 3, on the promenade deck, all for first class passengers. There are 45 large cabins for second class passengers, 21 of which are for 2 persons and 24 arranged to accommodate 3 persons. There are 20 bathrooms, independent of those connected with the special cabin, for the accommodation of cabin passengers. The lower deck has accommodations for 600 emigrants. Taken in all, the vessel can accommodate 1,090 passengers—392 first class, 98 second, and 600 steerage.

The Recent Transit of Mercury.

In the June *Sidereal Messenger*, Dr. E. E. Barnard, of Lick Observatory, gives the following brief report:

The transit of Mercury was successfully observed here on May 9 with the 12 inch equatorial.

The day proved clear throughout, though the preceding few days promised anything but a clear day for the 9th.

The first and second contacts were observed, the planet being sharply caught at the position angle predicted by Mr. Schaeberle:

1st contact 1891, May 9. 3 h. 46 m. 32·7 s., Mt. Hamilton, M. T.
2d contact 1891, May 9, 3 h. 51 m. 19·9 s., Mt. Hamilton, M. T.

I also made forty-six filar micrometer measures for the polar and equatorial diameters of Mercury, and eleven measures of the position of the planet on the sun's disk.

No trace of Mercury could be seen before first contact, though it was carefully looked for, nor was that portion off the sun visible between first and second contacts. No bright spot was seen on the planet, nor any atmospheric ring—such as was seen about Venus at the transit of December 6, 1882. A careful examination of the sun's disk showed nothing that could be taken for a satellite.

Some excellent photographs of the transit were made by Mr. Burnham with the 12 inch between the micrometer measures.

As a matter of popular interest, I would say that a preliminary reduction of the measures for the planet's diameter gives 2,960 miles for that value, which must be taken as altogether provisional, until the measures are thoroughly reduced. The measures do not indicate any polar compression.

NOTE.—The times of contact expressed in standard Pacific time (8 h. slow of Greenwich) would be

1st contact, 3 h. 53 m. 7·0 s.
2d contact, 3 h. 57 m. 54·2 s.

MR. CHARLES H CRAMP is authority for the statement that it is entirely out of the question for an American shipbuilder to duplicate exactly a British ship or to follow out British specifications and plans, because American vessels are in advance, and there is no comparison when the outfit of the vessel is considered. Another point he makes is the fact that when foreign shipbuilders are asked to duplicate an American ship, or build entirely on American plans or methods, they always ask as much as American builders. This has been confirmed by evidence furnished by Mr. Cramp, and the whole summing up means that a contract for an inferior vessel will not be undertaken here on competitive terms, but that our shipbuilders stand ready to duplicate first-class steamers at the same cost of construction as abroad.—*Marine Journal.*

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Correspondence.

An Intermittent Jet.

To the Editor of the Scientific American:

As you seem never to tire of hearing suggestions on jet propulsion, and as I have not seen one yet that might be patented as having an alternating current novelty, please permit me to offer the suggestion, that possibly the thrusts from a jet pipe intermittently worked might produce greater propulsion results than the constant jet, which tends more to bore a hole in the resisting element, which also follows in, to aid this effect. W. H. WETHERILL.

Philadelphia, Pa., June 15, 1891.

Natural Gas at Stockton, Cal.

To the Editor of the Scientific American:

It is now some twenty-five or more years since I wrote you a short letter describing the artesian well in the court house yard of this city. I mentioned the fact, and fact it was, that there came to the surface a quantity of gas—sufficient to ignite and burn, showing quite a flame. You very kindly published my letter, or rather a portion of it, cutting out the portion that referred to the natural gas. I now write for the purpose of informing you that my residence was lighted last evening for the first time with natural gas. We have no less than six wells in successful operation, furnishing gas for mechanical purposes, for cooking, heating and illumination.

The Crown mills are lighted with natural gas, and during the day time the gas is turned under the boilers for fuel. The new court house is lighted wholly, and heated, when heating is required, by natural gas furnished from a well bored for the purpose. Many of our business houses are lighted by natural gas, also a great many residences.

There are several wells now being bored, some of them indicating an abundance of gas. We do not get dry gas thus far.

I write this merely to correct an erroneous impression that you formed regarding the letter written a quarter of a century ago. You thought I told a California whopper, and it has troubled me for twenty-five years. Now I can vindicate my character. H. S. SARGENT.

Stockton, Cal., June 13, 1891.

Castronography.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of May 16, there appeared an article headed "Castrography," credited to *La Nature*. Allow me, in justice to myself, to contradict the following statement given in that article: "It was devised by Mr. Mills, an American." I claim this to be false. From one end of the United States to the other, from England to Australia, and over the Continent, as well as Canada, I have exhibited myself as "The Knife Artist" for the last twenty years. My name is everywhere known in connection with this work. I first introduced the idea in the United States quite by accident, while cutting a thick piece of card board. My knife slipped and made a long shaded gash on the surface. I mechanically looked at it, and noticed the shade. An idea struck me. It was this: if a knife makes such a pretty shade with a stroke, why not combine many strokes of like nature into a design? I first executed a few pen and ink sketches, such as shaded birds in ornamental penmanship, and cut them with a knife. I gradually noticed that I could use the pen knife fully as well on the card as the pen, and practiced this new idea thoroughly; and to-day I stand the originator of the art of "Castronography" (not Castrography). I am not only the originator, but I frankly confess to being the "king" of all my imitators; for such are all that do this kind of work, as many a citizen in the United States can testify. I have been well known for years at every noted watering place. I am out of the business now, as the idea ceased to be a novelty. I invariably left my tracks behind in the shape of an imitator. To make this statement good, I will offer Mr. Mills or any one else $100 if he can prove that he is the originator of the above art, and that I am not. Further, the specimens reproduced are *very, very poor* in skill as well as in design. Mr. Editor, I would not have written this letter for publication, but it is a fact that many people get the credit in newspapers (through cheek and other means) for things they have no right to lay claim to. There are hundreds of men doing this work in the world to-day, and to use the "Yankee" phrase, it is getting to be a "chestnut," and well it should, for nine out of ten of the so-called "knife artists" make such a miserable botch of a beautiful art that the public cease to take the interest in it they once did, when I could get one dollar for a card with a design upon it cut with a knife. In conclusion, I will state that any ornamental penman can do the same work with a knife as with a pen with a little practice, as it is only writing with an instrument without ink. Hoping you will give honor to another American where honor is due.

Toronto, May 23, 1891. G. MILKMAN.

[The above letter was accompanied by several fine specimens of the art.—ED. SCI. AM.]

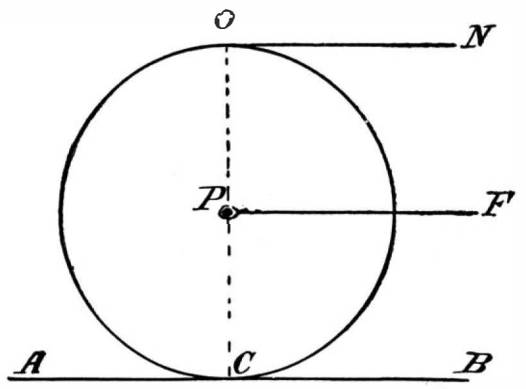
THE ROLLING WHEEL.

To the Editor of the Scientific American:

In *Popular Science News* of November, 1890, in answering the question, "Does the top of a rolling wheel move faster than the bottom?" the editor says: "The top of a carriage wheel moves *faster*, with reference to the observer, than the bottom, because, in addition to its movement of rotation, it has the direct forward movement of the carriage as a whole. The *bottom* of the wheel moves in an opposite direction to that of the wheel itself, and, as the two motions partially neutralize each other, the bottom part *appears* to move past the observer more slowly than the top."

"Faster," in the sense in which it is here used, implies that the bottom of the wheel moves, but not so fast as the top.

There is no point in a rolling wheel which moves in an opposite direction to that of the wheel itself. The top of a rolling wheel moves twice as fast as the center, while the *bottom* of the wheel is as stationary and motionless as is the cornerstone of Bunker Hill monument.



That the top of a rolling wheel moves twice as fast as the center may be easily demonstrated by taking a round block, such as merchants' ribbons are wound on, stick a pin in the center, on one end. Around this pin tie a thread loosely, so that the pin can revolve in the knot without winding the thread, then fasten the end of another thread to the circumference of the roller and wind *this* thread several times around the roller Let the upper thread lead off from O toward N, and let the center thread lead off from P toward F. Roll the wheel toward the right hand, and you will discover that the upper thread "pays out" just twice as fast as does the center thread.

Now, in the vertical line, C P O, the distance from C to O being twice as great as the distance from C to P, if the point O moves twice as fast as the point P, it is a simple mathematical proposition that the point C is without motion, being merely a center around which the line, C P O, revolves.

In the case of a cogged wheel rolling on a cogged rail, the space between two adjacent cogs in the rail being stationary, a cog in the wheel, which fits that space, must necessarily remain stationary so long as it is in the stationary space.

If we take a carriage wheel containing 14 spokes and remove the tire and felly and cause the wheel to roll at the rate of one revolution in 14 minutes, it must be plain that when spoke No. 1 comes in contact with the ground—*i. e.*, becomes the bottom of the wheel—the lower end of the spoke remains stationary, and is merely the point on which the whole wheel rocks for the space of one minute, or until spoke No. 2 strikes the ground.

If there were 14 million spokes in the wheel, and if it made 14 million revolutions in a second, the lower end of each spoke would come to a full stop as it struck the ground; but would tarry for the space of only 1-196,000,000,000,000 of a second.

Theoretically a circle is a polygon. The distance from any point in the circumference of a circle to the very nearest next point must be *something*, though infinitesimally small. So long as any point in the circumference of a rolling wheel is the *bottom*, it acts as a pivot, and is at a dead rest until the next point becomes the bottom, when the point that *was* the bottom begins to rise.

Inclosed is a diagram showing the lines described by different points in a rolling wheel.

A B represents the ground on which the wheel, C E O, rolls.

The curve described by a point in the circumference of a rolling wheel is termed a cycloid, and its properties are discussed in the calculus. A. J. KNISELY.

A Remedy against the Teredo.

To the Editor of the Scientific American:

We have just read some articles in your paper on the loss on the Pacific coast from the destruction of lumber by the teredo pest, a remedy for which we have discovered, and successfully tested, on the Pacific coast. For some years we have prepared a wood preservative which has prevented all wood treated with it from decaying. In June, 1888, we steeped a piece of wood in an extra solution of our preservative and sent it to H. Abbott, Esq., General Superintendent of the Canadian Pacific Railway, at Vancouver, B. C., asking him to have it tested in the worst place for the teredo on the coast, attaching to it a like piece of wood unpreserved. Mr. Abbott writes me that in twelve months the piece of wood not preserved was completely riddled by teredoes; our treated piece was untouched by them. He continued the test, and after an exposure to their attacks for two years the teredoes made no impression on it. He recommended its use to the company, for whom we have recently filled a large order and sent to Vancouver. It is not costly, and can be prepared wherever needed, in any quantity, and so strong that the teredo or any other animal or insect will not touch it. Before preparing this remedy we studied the habits of the teredo, and find that we have succeeded in providing against so destructive a pest. The cost of preserving ordinary lumber by our process is from $2 to $3 per 1,000 feet B. M. Teredo proof for wharf piles would of course be higher. It is as sanitary as concrete, not easily ignited, and not dangerous to manufacture or use.

THE FINCH WOOD PRESERVATIVE COMPANY.

Toronto, Canada, June 9, 1891.

Growth of Hair after Death.

To the Editor of the Scientific American:

An unusual event was chronicled in the SCIENTIFIC AMERICAN of June 13, that of a man adding a full hirsute appendage to his face after death. The SCIENTIFIC AMERICAN spoke as follows:

"The body of E. M. Haskell, who has been dead for over twenty years, was recently removed from his grave at Northfield, Minn., it being purposed to put the body in another lot. When the body was exposed it was found that he had a beard over twenty-three inches long. His wife said that before he died he had been shaven, and all his hair must have grown after burial."

This is substantially the report that was telegraphed from Northfield to the Chicago *Tribune* and other leading papers over the United States, no details having yet been published of this most remarkable occurrence.

There are perhaps two or three well authenticated precedents of this phenomenal post mortem happening, but it is probable that none has borne the unflinching scrutiny to which this case has been subjected. Savants and press representatives, idlers and people filled with morbid curiosity, have thronged the city, and well nigh harassed the life out of the relatives of the deceased. The writer was one of the first on the field, and on that account was given more complete information than has yet been made public.

E. M. Haskell died on the 13th day of November, 1868, aged forty-one years. For the last ten years of his life he had worn only a mustache, which was unusually heavy. The disease that caused his death was pronounced brain fever by the attending physicians, and he died after an illness lasting barely two days. He was a short, dark-hued man, of great vitality. He was buried in a stone vault placed about seven feet beneath the surface of the ground, and enjoyed an unbroken repose until the 7th day of June, this year, when, the tombstone crumbling, and the ground beginning to become uneven, his wife, an old but still healthy lady, decided to remove the body to a new lot which she had recently purchased.

Accordingly two men were instructed to effect the removal, and the corpse would probably never have been seen, and an interesting natural phenomenon thus be lost to the world, had not one of the straps used to raise the body out of the vault broken when the coffin was near the top, and thus precipitated it to the hard stone bottom of the grave. The result of this shock was that the lid of the coffin, which had rotted considerably, became removed, and the face of the corpse thus exposed.

One of the men, who had been in the employ of Haskell at the time of his death, started back in surprise, and exclaimed, "That ain't him!" On being questioned by his fellow laborer, he said that his old master had had no such long beard as "that feller there."

He hurried to his old mistress, and with some reluctance she was persuaded to go and view the remains. She also gave vent to an exclamation of surprise on seeing the long black beard and hair, nearly two feet in length, and at first emphatically denied that the body was that of her late husband. But closer examination brought facts to light that could not be mistaken, and the identity was firmly established.

The body had partially decomposed, but the face, though lean and almost entirely devoid of flesh, still retained its perfect covering of epidermis, and the beard as well as the hair was of a deep glossy black. The tomb had been cemented, both top and bottom, and air thus excluded to a certain extent.

Here is a well verified case of the activity of certain functions of the body after apparent cessation of the life current. A. R. FEDERMANN.

Northfield, Minn., June, 1891.

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A HYDROCARBON BURNER FOR STOVES, ETC.

A simple and efficient burner which may be readily applied to various shapes of stoves, and is designed to furnish a great heat at small cost, is shown in the accompanying illustration. Bolted to and extending entirely around the inner side of the stove casing is a narrow flanged ledge, upon which rests the stack, having a curved and forwardly projecting hinged back. Within the stack is an oil box, supported upon a transverse bar suspended by bolts from the ledge, the distance between the bar and ledge being adjustable. The oil box has a central oil chamber in its upper face and vertical flanges around its edges, while a feed pipe extending through an opening in the front of the stove casing bends upwardly through an aperture in the base of the box, the upper end of the pipe having lateral perforations in a chamber beneath the deflector, which fits closely between the flanges of the oil box. The deflector fits within and is bolted to the flanges of the oil box, is open at both ends and on the front side, and is provided with bottom perforations to admit oil, while the lower part of the deflector is completely filled with a wick of closely coiled wire or similar indestructible material, the packing of the wire being designed to facilitate the passage of oil vapor upward through it. A steam pipe with perforations on its sides extends horizontally through the upper rear part of the deflector, just above the wick, and beneath the pipe is a dish-shaped steam pan, designed to throw the steam to the front side of the burner, and catch any drops of water, which will be quickly turned into steam by the heat of the pan. Sufficient oil having been fed to flow upward into the wick, it is lighted and the steam turned on, after which the feed is regulated so that the oil will only pass a little above the bottom of the deflector, the oil being vaporized by the heat of the wick, when the oil vapor and steam are combined in a gas which burns brightly, the flame issuing from beneath the front and ends of the top plate of the deflector. This improvement is designed to be readily fitted to any style of stove casing, and, when located near a flue, chimney, or other air passage, is designed also to afford an excellent ventilator for living and cooking apartments. The parts liable to deterioration are but few, and can be readily replaced without the aid of a skilled workman.

For further information relative to this invention, address the patentee, Mr. Charles E. Cookerly, or Mr. Grant Davidson, of Kansas City, Mo.

THE SYSTEM OF MILITARY DOVECOTES IN EUROPE.

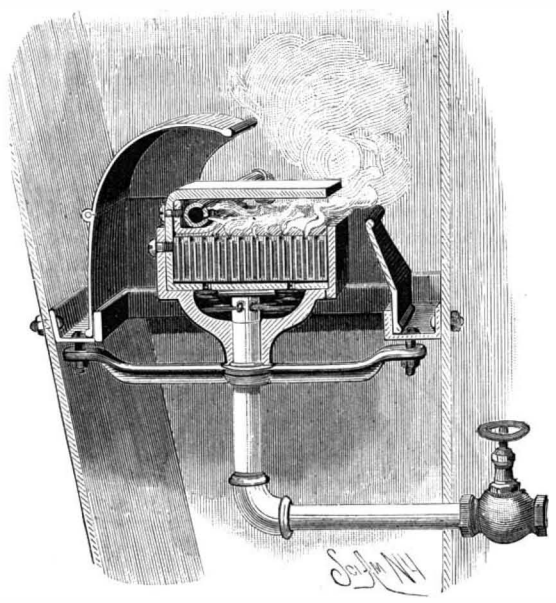
In the organization of the system of military dovecotes, the locations of the stations are, almost all of them, decided upon in advance. It is a question, in fact, of connecting the fortresses of the frontier with each other and with a central station. There is generally no difficulty with fortresses that are almost always so near each other that ordinary pigeons can easily effect a passage from one to the other. The same is not the case with the central station, at least in great empires, such as Russia, Germany, etc. In this case it is necessary to establish relay stations between the frontier and the center of the system.

One has, in fact, to stand between two dangers, viz., on the one hand, of having journeys to be made that exceed the strength of the average of pigeons, and, on the other, of too greatly multiplying the stations and consequently the loss of time that always occurs at the start, when the bird is taking its bearings, or on reaching home, when it is hesitating to enter its cote. The superiority of communications by pigeons over other methods of transmitting dispatches increases with the distance. Thus a direct train takes thirteen hours to make the 300 miles that separate Paris from Lyons—a distance that can be traversed in eight or nine hours by a pigeon.

It is generally admitted that it is possible, almost to a certainty, to make an ordinary pigeon (such as those with which the military cotes are stocked), provided that it has been carried away, accomplish a journey of from 30 to 90 miles in a single stage, and that, too, in a space of time varying from one hour to four hours. The nature of the country has a great influence upon the facilities of the trip, not only on account of the obstacles presented by chains of mountains, but also by the delays and dangers that pursuit by birds of prey cause the messengers to undergo. A journey of 180 miles over a level country will be more easily made than one of 60 over a hilly one.

So, in the details given further along as to the various systems, we shall see that, by way of exception, it has been possible to carry the distance between two stations up to 180, and even 240 miles.

When stations have to be established upon mountains, it is necessary to install them, not upon the highest points, even though they would thus have the advantange of being discernible, but in the valleys and at the side of the roads, for it is through the necks where these valleys and roads end that the pigeons always endeavor to cross chains of mountains, provided the latter exceed the mean altitude of flight.



COOKERLY'S HYDROCARBON BURNER.

In certain countries, the military pigeons are carried away only at the beginning of spring, just as are the ordinary carriers, the sole objective of which is contests in the races of autumn. This is an error, for, in time of war, it is necessary that the messengers of the fortresses shall be habituated to brave inclement weather. The Societe Estafette Lyonnaise, this past winter (1890–91), made an experiment in this direction. It lost 43 per cent of the pigeons, but the number of these that arrived permits of the hope that, with proper precautions, this service will enter into practice. Further along, we shall see that what took place at the time of the siege of Paris confirms this favorable opinion.

In every station there must be as many dovecotes, or at least as many distinct parts of a dovecote, as there are corresponding stations, so that it shall be always the same pigeons that are carried away in the same direction.

At the age of six months, these pigeons come to know their way so well that, for distances of 120 miles, there is, taking into consideration storms, the shot of hunters, and the claws of rapacious birds, one chance in three that they will reach their destination. In order to be sure that a dispatch will be transmitted, it will suffice, then, to confide it to three messengers, or to four at the most, during unfavorable winds or weather. From this it results that if we wish to be able to send a message every day during an investment of six months or 180 days, it will be necessary to have an effective force of 180 by 4, or 720 pigeons for each station with which it is desired to communicate, the distance of such stations being less than 120 miles. If the distance is greater than this, we can no longer depend upon six months' old pigeons, whose strength and rearing are generally inadequate, but it will be necessary to have recourse then to pigeons of one, two, three, and even four years, when the journey to be accomplished reaches 240 miles. It will be well at the same time to increase the number of carriers of the same dispatch. As a general thing, it is necessary to employ one pigeon more for each extra 30 miles, so that, for example, for 150 miles we would let loose 5 pigeons of from 1 to 2 years; for 180 miles, 6 pigeons of from 2 to 3 years; for 210 miles, 7 pigeons of from 3 to 4 years; and for 240 miles, 8 pigeons of from 3 to 4 years.

These figures are only approximate, for the value of a pigeon does not always depend upon its age. One that is excellent for service in rainy weather may be worth nothing in a wind, and *vice versa*. It is, therefore, of prime necessity that the keepers of military dovecotes shall make it a point to know personally all the birds in their charge, and to take note of their aptitude.

The installation of military dovecotes is about the same throughout Europe. Sometimes they are established in isolated pavilions and sometimes in the upper stories of magazines or barracks.

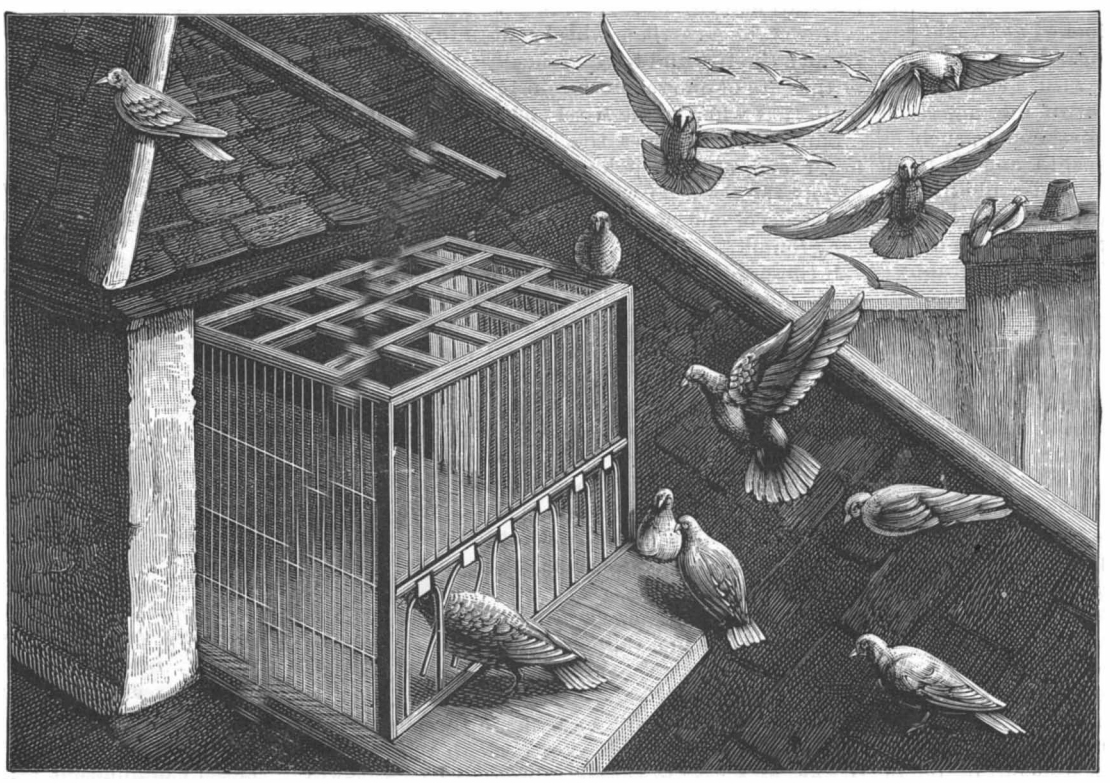
The cut represents the military dovecote of Grenoble that I have had installed in the upper story of a tower of the ancient wall built in 1401. Attention should be especially directed to the safety of the birds, which should be carefully protected against the attack of cats, rats, or other carnivorous animals.

Each dovecote should be provided with several compartments. First, there is the apartment for paired pigeons, in which the birds generally remain when they re-enter the cote. Each pair has its own cage, the height and length of which is twenty inches, while the width is from twenty-four to twenty-eight inches. Two plaster nests are placed in each cage, one of which will serve for the young, while the other will contain the eggs.

Just alongside there should be a second apartment, fitted, or not, with cages. The pigeons are confined in this in the month of October, the epoch at which the males should be separated from the females. A little further along is the infirmary, into which all sick pigeons are put, so that they may not communicate the disease with which they are afflicted to the other birds.

Finally, the entrance cage completes the installation of every dovecote. Generally, this cage is placed at the window of the apartment for paired birds and communicates therewith. Little swinging wickets allow the birds to go in and out. A bar put in place by the keeper prevents the wickets from moving in both directions at certain moments, and then permits the birds only to enter the cote.

In order to give the pigeons more air, and, at the same time, to allow the keepers to seize them easily, rooms are selected that have a sufficiently high ceiling, and in these are established, at a height of six feet, a second and open ceiling of laths, which prevents the birds from flying out of reach of the hand.



ENTRANCE CAGE OF A FRENCH MILITARY DOVECOTE.

Clay and bits of wood are placed within reach of the pigeons in order to permit them to build their nests. In the interior of the cote there are wooden trays for seeds, and leaden troughs, or small apparatus of special form, for water. The food consists of vetches, beans, and Indian corn. Cereals, hempseed, and a little salt may also be given. The birds complete their ordinary fare by swallowing grains of sand or small pebbles.

Three meals a day are served to them in summer—one at 5 o'clock in the morning, one at noon, and one at 6 o'clock in the evening. In winter they are fed but twice a day—at noon and at 5 o'clock. It costs from 25 to 30 cents per month to keep each pigeon.

Thus treated, the birds reach their complete development in three years, and are capable of performing good service as messengers until the age of fifteen or sixteen years. They have been known to attain a longevity of twenty years, but it is between the ages of two and six years that they display all their qualities.

For carrying the pigeons away from the military dovecotes, it is well, the first year, to adopt the following rule:

The distance of a letting loose of the birds will be obtained by adding to the distance of the preceding

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one a half of such distance, being expressed by the formula

$$Dn = Dn - 1 + \frac{Dn - 1}{2}$$

Thus the first turning loose being say 10 miles, the second will be 10 + 5 = 15 miles, the third will be 15 + 7½, and so on up to 120 or 180 miles, that is to say, up to the distance that the messengers are never to exceed.

As soon as a mobilization of the army has been decreed, there will be taken from each cote all the pigeons that are carried in the direction of the neighboring places, and these will be conveyed respectively to such places along with the men who are accustomed to care for them, and who must remain there until the cessation of hostilities.

All these permutations must be effected on the same day, so that every lot of pigeons shall find the place free on arriving.

In a succeeding article I shall give a few as complete details as possible as to the systems of military dovecotes of the principal powers of Europe.

Such data, however, will be merely approximate, since it is for the interest of every state not to allow its neighbors to become too accurately informed as to what is going on within its borders, and not to divulge its processes.—*Lt. Col. De Rochas, in La Nature.*

PNEUMATIC SIGNALING UPON THE CENTRAL RAILROAD OF NEW JERSEY.

The Westinghouse automatic signaling system, now in daily operation upon the Central Railroad of New Jersey, has already been described in our columns. We illustrate in the present issue some further features of its operation, touching more especially upon the details of its electric and pneumatic connections.

The line of road operated by it is divided into blocks. From motives of safety these blocks should be as long as possible, but in the present case the number of trains which pass over the road necessitate short blocking, each block being from 1,000 to 2,500 feet long. Two semaphore signals are used at the beginning of each block. One indicates "caution" when the next block but one has a train upon it; the next indicates "danger" when the next block has a train upon it. The semaphore indicating danger is termed the "home" signal, the other the "distant" signal. The upper one is the home signal, the lower is the distant one.

The system in general terms operates by pneumatic pressure. The operating valves of the air pressure pipes are opened and shut by the agency of an electric current. The rails are used as part of the circuits for the current. To them the wires are connected by pins driven into holes drilled in the web of the rail. This method of connection is shown in one of the cuts. Where the rails abut, if they are to be connected electrically, a short piece of copper wire is carried across the joint and connected in like manner by two pins, one driven into a hole in the web of each rail.

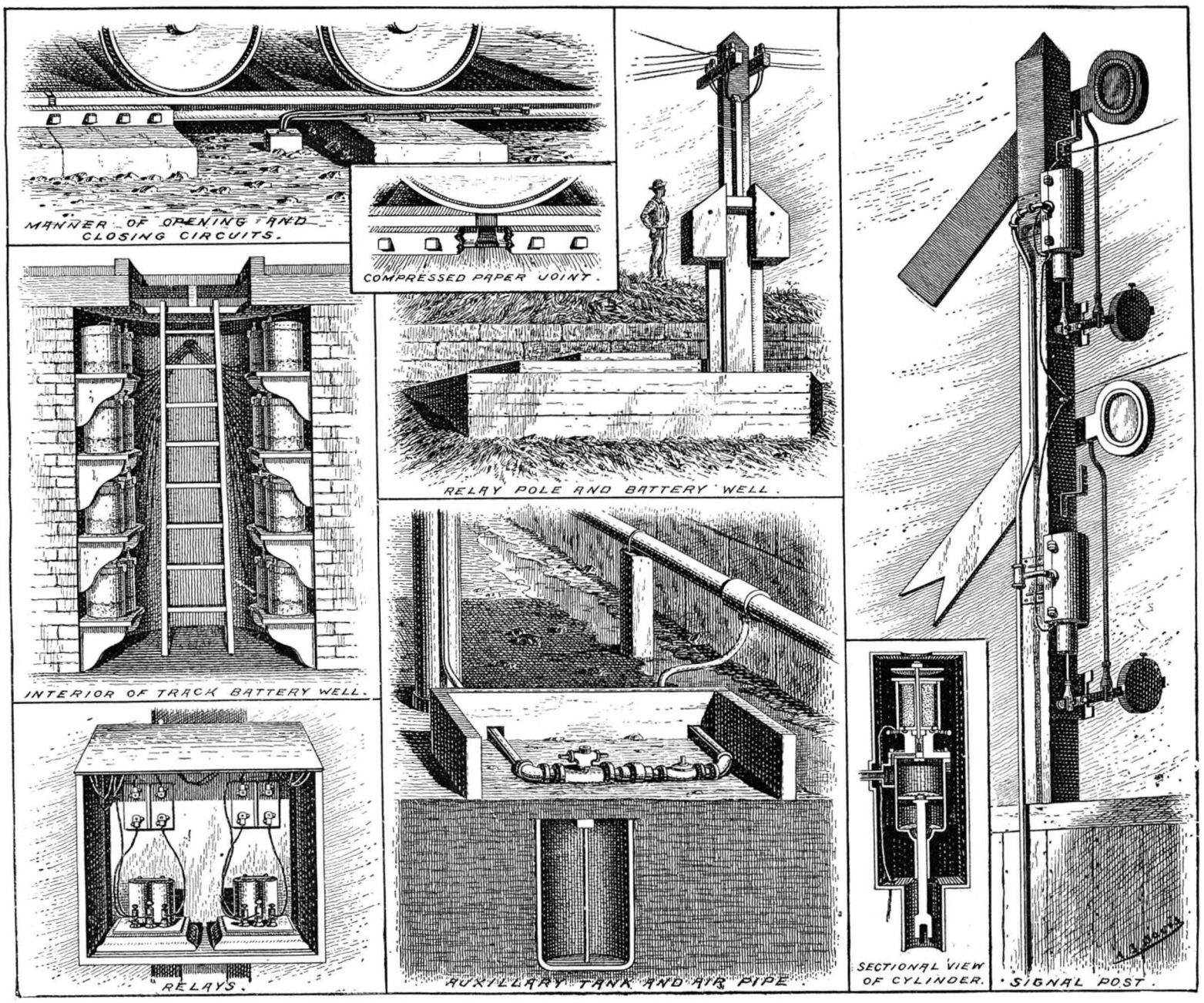
Each block has to be insulated from its neighbor. In order to secure this, compressed layers of paper are inserted between the ends of the rails, as shown in the cut.

The electric batteries are established in little cisterns or wells, underground, along the side of the road. The gravity battery is used, and as it is on closed circuit much of the time, it is maintained in good condition. Over each well is the relay pole, whence wires run to the semaphore poles. The relays, battery and well, and a relay pole are also shown. The well is large enough to give ample room for an operative to clean, refill, or charge the batteries as required.

A semaphore pole is placed near the beginning of each block. It carries two semaphores. Each is raised to "danger" or "caution" by a counterweight. A pneumatic cylinder and piston is connected to the arm of the counterweight in such a way that as long as the air pressure is maintained the signal remains at safety. The air pressure is turned on by an electrically controlled valve, which, with its solenoid and armature, is seen in the cut immediately above the piston. Hence for air pressure to act upon the piston the solenoid must be excited. To secure quick action of the pneumatic cylinders, air reservoirs are established at intervals along the track. These obviate the necessity of air passing through long lines of pipe, with attendant friction and "wire drawing." Thus prompt action is secured.

The trains by bridging the tracks operate the electric circuits. As long as everything is intact and the tracks are empty the solenoids are excited, their armatures are depressed, and the air valves are open. The air depresses the piston and forces the semaphores into the safety position. If an engine or train enters upon a block it short-circuits the solenoids, affecting the danger signal for its own and the caution signal for the block behind it. The air valves move and the air escapes from the pneumatic cylinders, and the semaphores drop into "caution" and "danger" positions respectively. As the train leaves the block, the distant caution signal circuit ceases to be short-circuited, the air valve is shifted, and the signal is forced by pneumatic pressure into safety again. The danger signal immediately back of the block it is leaving is affected in like manner, and the two semaphores next in advance drop into the position of warning.

The great point about the system is that the work of the whole apparatus is holding the signals at safety. If anything happens to break a connection, if the air pipes leak or are fractured, or if any interference is suffered so that the apparatus ceases to act, every signal falls at once into "caution" and "danger." It is in this respect that the perfection of the system appears in the strongest light. An accident, which makes it inoperative at once, signals a full stoppage to every train upon the road.



PNEUMATIC SIGNALING ON THE CENTRAL RAILROAD OF NEW JERSEY.

The Steel Steamer Roman.

The steel steamer Roman, built to the order of the Menominee Transit Co. by the Globe Iron Works Co., Cleveland, O., was lately launched from the yards of her builders.

The Roman is the last of a fleet of six high classed, full powered steel steamers built by the "Globe" for the same owners, and named respectively the Norman, Saxon, German, Briton, Grecian, and Roman.

The dimensions of the Roman are as follows: 312 feet 6 inches over all; 296 feet 6 inches keel; 40 feet beam and 24 feet 6 inches moulded depth. Engines, triple expansion, with cylinders 24, 38, and 61 by 42 inch stroke; two Scotch type boilers 12 feet 6 inches in diameter by 14 feet in length, for a working pressure of 160 pounds; her propeller wheel is 14 feet in diameter, with a lead of 17 feet. She is estimated to carry 3,000 tons on a 15 foot 6 inch draught. Her coefficient of fineness is 0·81, which proves that her machinery is very superior to obtain the maximum speed which she is guaranteed for. It is estimated that she will consume 1·70 pounds of coal, developing an I. H. P. of 1,870. She has four water tight compartments, including the collision bulkheads; her upper deck is of steel, lap-plated with thwartship seams and double riveted butt straps of three-eighths steel; her stringer plates are also double strapped and triple riveted; main deck of four inch pine.

THE law of the United States is that bridges over navigable streams must be built under the sanction of the War Department. The law is to be more vigorously enforced than formerly.

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The Sandstone Industry.

Mr. Robert P. Porter, Superintendent of Census, reports that census *Bulletin* 73, in relation to the sandstone industry, was prepared by Dr. William C. Day, special agent, under the supervision of Dr. David T. Day, special agent in charge of the division of mines and mining of the Census Office.

The amount of sandstone produced in the United States in 1889 was 71,571,054 cubic feet, valued at $10,816,057, while for 1880 the value was only $4,780,391, an increase during the decade of $6,035,666, or 126·26 per cent. There were 16,925 workmen employed, to whom were paid in wages $6,257,580. The total expense of producing sandstone in 1889 was $8,130,295, and the total capital invested $17,776,467, of which $11,501,100 was invested in land.

The name "sandstone" is applied to stone which has been formed by sedimentary deposit from water of granules which have resulted from the disintegration of older rocks by various kinds of dynamic action, weathering, and erosion. Naturally, therefore, grains of quartz, the hardest essential component of the older rocks, are vastly more abundant in sandstone than all other minerals; indeed, most sandstones are almost entirely made up of particles of quartz. Other minerals, however, occur. Various varieties of feldspar and mica are frequently found, while small amounts of still other minerals are occasionally observed, but there is by no means the variety which characterizes the constitution of granitic and volcanic rocks.

The size of the granules composing sandstone is quite variable, giving rise to the distinction between the fine and coarse grained varieties.

The granules constituting sandstone are usually held together by some cementing material, and the nature of the latter is an all-important consideration bearing upon the strength, durability, and beauty of the stone, and, consequently, upon its value as a structural material. Some sandstones are apparently without this cementing or binding material, and are particularly desirable as abrasive material, although they may also form good building stone.

Lithologically considered, the different kinds of sandstone are classed with reference to the cementing material rather than to the mineralogical nature of the component granules. Argillaceous sandstone is one in which the cementing material is clay, and in cases where the clay has not been subjected to metamorphic action, such stone is subject to disintegration under the influences of weather.

In calcareous sandstone the cementing material is calcium carbonate, and when the latter is present in great excess, the stone is called siliceous limestone. Limestone being readily acted upon by acids, disintegration may easily result from atmospheric agencies.

Ferruginous sandstone is one in which the cementing material consists of oxides of iron, which determine the color of the stone when it is pink, red, brown, or shades intermediate between those named.

Siliceous sandstone is that in which the cementing material is silica, so that the rock consists of almost pure silica. Such stone is usually hard, durable, capable of withstanding great crushing strength, and is not subject to alteration in color, and as a consequence of its extreme hardness it is naturally difficult to work. This kind grades into quartzite, which has been hardened by heat and pressure.

Freestone is a name of popular origin, and is applied to such sandstones as work well in any direction. The terms "arkose," "conglomerate," and "breccia" are names which have special reference to the character of the granules present. Arkose is composed of the constituents of granitic rocks which have been disintegrated and reconsolidated into sandstone, and conglomerate is a sandstone in which the granules are rounded pebbles instead of small grains. When these fragments are angular instead of rounded, it is called breccia.

The terms "quartzose," "feldspathic," and "micaceous" sandstone refer to the presence of the minerals implied by these names.

The commercial names of sandstone are usually found by reference to the places at which they are quarried, as Portland brownstone, Berea grit, etc.

The stone commercially known as bluestone, in so far as it comes from certain sections of the States of New York, New Jersey, and Pennsylvania, is not included here.

The table following shows the relative standing of productive States according to the last census; while eighteen States only were productive in 1880, the number has now reached forty. Ohio is first. According to the eleventh census, Colorado holds third place, while ten years ago it held sixteenth place among the productive States. The vast increase in the sandstone production of this State, namely, from $9,000 to $1,224,098, is due largely to the operations of the Union Pacific Railway Company. This company is not only one of the most extensive producing concerns, but the facilities for shipment which they afford to other large producers account in a great measure for the striking increase in production. Enormous shipments of sandstone are now made from Colorado to remote parts of the United States, and the business is in a most flourishing condition. Another notable change is the appearance of California as a productive State, holding eleventh place.

OUTPUT OF SANDSTONE IN 1889.

1. Ohio	$3,046,656	20. Utah	$48,306
2. Pennsylvania	1,609,159	21. Indiana	43,983
3. Colorado	1,224,098	22. Alabama	43,965
4. Connecticut	920,061	23. Montana	31,648
5. New York	702,419	24. Arkansas	25,074
6. Massachusetts	649,097	25. Illinois	17,896
7. New Jersey	597,309	26. Wyoming	16,760
8. Michigan	246,570	27. Texas	14,651
9. New Mexico	186,804	28. North Carolina	12,000
10. Wisconsin	183,958	29. Virginia	11,500
11. California	175,598	30. Maryland	10,605
12. Missouri	155,557	31. Arizona	9,146
13. Kansas	149,289	32. Oregon	8,424
14. West Virginia	140,687	33. New Hampshire	3,750
15. Minnesota	131,979	34. Tennessee	2,722
16. Kentucky	117,940	35. Idaho	2,490
17. South Dakota	93,570	Other States	26,199
18. Iowa	80,251		
19. Washington	75,936	Total value	$10,816,057

The general purposes to which sandstone is applied are as follows:

FOUNDATIONS, SUPERSTRUCTURES, AND TRIMMINGS.

Solid fronts.	Kiln stone.
Foundations.	Capping.
Cellar walls.	Belting or belt courses.
Underpinning.	Rubble.
Steps.	Ashlar.
Buttresses.	Forts.
Window sills.	Dimension.
Lintels.	Sills.

STREET WORK.

Paving blocks.	Road making:	Macadam.
Curbing.		Telford.
Flagging.		Concrete.
Basin heads or catch basin covers.	Sledged stone.	
Stepping stones.	Crushed stone.	

ABRASIVE PURPOSES.

Grindstones.	Shoe rubbers.
Whetstones.	Oilstones.

BRIDGE, DAM, AND RAILROAD WORK.

Bridges.	Capstone.
Culverts.	Rails.
Aqueducts.	Ballast.
Dams.	Approaches.
Wharf stone.	Towers.
Breakwater.	Bank stone.
Jetties.	Parapets.
Piers.	Docks.
Buttresses.	Bridge covering.

MISCELLANEOUS.

Grout.	Cemetery work.
Hitching posts.	Watering troughs.
Fence wall.	Fluxing.
Sand for glass.	Ganister.
Sand for plaster and cement.	Fire brick, silica brick.
Furnace hearths.	Lining for steel converters.
Lining for blast furnaces.	Glass furnaces.
Rolling mill furnaces.	Core sand for foundries.
Adamantine plaster.	Random stock.
Millstones.	

METHODS OF QUARRYING.

The work of quarrying sandstone is greatly facilitated by the ease with which parallel top and bottom beds may be obtained. In most cases good natural beds or partings parallel to the stratifications may be taken advantage of by the quarryman, and the rock is said to be thick-bedded or thin-bedded owing to the thickness of these sheets. The beds in the majority of quarries are horizontal or nearly so, and the object desired is to cut or break the sheets into rectangular blocks through to the bedding planes below. Much of this work was formerly accomplished by gunpowder used in the ordinary way or by heavy charges of powder contained in tin canisters and exploded in specially large drill holes. These processes have been supplanted in the larger quarries by the Knox patent system of blasting rock and by the more extended use of steam channeling machines, such as are used in quarrying marble. The Knox system is particularly efficacious in thick-bedded sandstone, and the channelers are specially serviceable where the sheets are thinner. Vertical joints in the rock are a great aid in quarrying, and where they are numerous channelers are not required, and but little powder is necessary in loosening the blocks.

In some quarries the Knox system is used also in blocking up or subdividing the rock after the initial cuts have been made. Ordinarily, however, the plug and feather method is used, or in a rather soft variety, like the Connecticut brownstone, grooves are cut with pickaxes and the stone is broken by driving iron wedges into the grooves thus formed.

Dyeing Recipes.

Black on 100 *lb. Cotton Knit Cloth.*—First, run cloth for one hour at boil through a bath of 20 lb. logwood extract, 1 lb. soda ash. Second, run for one-half hour through a cold bath of 4 lb. blue vitriol. Third, run for one-half hour through a cold bath of 2 lb. bichromate of potash. Wash and extract. Repeat through the spent baths of logwood extract and blue vitriol, and sadden with 2 lb. copperas. This is a very handsome black on cotton Jersey cloth, and the recipe given above will no doubt engage the attention of many dyers. Great care must be exercised in dyeing black on this class of goods, in order to obtain perfect evenness, and, although this process is long, requiring six operations, evenness as well as fastness of color is secured.

Bluish Magenta on 100 *lb. Wool Yarn.*—Make up dye kettle containing 8 oz. acid magenta, 2 oz. nigrosine, 3 lb. oil of vitriol, 10 lb. Glauber's salt. Enter yarn at 140° F., bring to boiling point while turning, and turn to shade at that heat. The dyer who needs rich purplish reds finds in this recipe and sample an easy and quick method of obtaining them by using acid magenta in combination with nigrosine, either in larger porportions to make bluer or heavier effects, or decreasing it for redder and lighter shades.—*Journal of Fabrics.*

The following is a list of prominent structures built of sandstone in some of the principal cities of the United States:

Locality.	Name of structure and date of erection.	Commercial name of stone.	Locality of quarry.
Albany, New York	All Saints' Cathedral	Potsdam sandstone	Potsdam, New York.
	Cathedral of the Immaculate Conception, 1852.	Brownstone	Portland, Connecticut.
	First Presbyterian Church, 1884		East Longmeadow, Massachusetts.
	Albany Academy, 1815	Nyack sandstone	Nyack, New York.
Albuquerque, New Mexico	Territorial University (wing)		Rio Puerco, New Mexico.
Baltimore, Maryland	First Presbyterian Church		New Brunswick, New Jersey.
	Mount Vernon Methodist Episcopal Church	Berea sandstone	Berea, Ohio.
Boston, Massachusetts	Second Unitarian Church	Red sandstone	Newark, New Jersey.
	New Old South Church	Pudding stone	Roxbury, Massachusetts.
	Tremont Street Methodist Episcopal Church	Pudding stone	Boston, Massachusetts.
	Hotel Brunswick	Buff Amherst sandstone	Amherst, Ohio.
Brooklyn, New York	Saint Ann's Protestant Episcopal Church		——, New Jersey.
	Academy of Design	Brownstone	Portland, Connecticut.
Carson City, Nevada	United States Mint	Sandstone	Canon City, Nevada.
Chicago, Illinois	Union League club house	Brown sandstone	Springfield, Massachusetts.
	Palmer House	Buff Amherst sandstone	Amherst, Massachusetts.
	Public Library	Berea sandstone	Berea, Ohio.
Cincinnati, Ohio	City Hall	Brownstone	Houghton, Wisconsin.
Cleveland, Ohio	Garfield Monument, Lake View cemetery	Berea sandstone	Berea, Ohio.
Colorado Springs, Colorado	First National Bank building	Peachblow sandstone	Peachblow, Colorado.
Columbus, Ohio	United States post office and court house.	Berea sandstone	Berea, Ohio.
Denver, Colorado	Arapahoe county court house		Canon City, Colorado.
	Tabor Grand Opera House	Buff Amherst sandstone, Manitou sandstone	Amherst, Ohio. Manitou, Colorado.
	Barclay block	Coal Creek sandstone	Coal Creek, Colorado.
Dover, Delaware	United States post office and court house	Berea sandstone	Berea, Ohio.
Grand Rapids, Michigan	City Hall	Blue Amherst sandstone	Amherst, Ohio.
Indianapolis, Indiana	Hotel Denison	Berea sandstone	Berea, Ohio.
Lansing, Michigan	State Capitol	Buff Amherst sandstone	Amherst, Ohio.
Leavenworth, Kansas	United States post office and court house	Blue Amherst sandstone	Amherst, Ohio.
Milwaukee, Wisconsin	Chamber of Commerce building	Blue Amherst sandstone	Amherst, Ohio.
Minneapolis, Minnesota	Westminster Presbyterian Church, 1881 to 1883.	Brown sandstone	Fond du Lac, Minnesota.
	United States post office and court house	Blue Amherst sandstone	Amherst, Ohio.
Newark, New Jersey	Old custom house and post office, 1859		Little Falls, New Jersey.
New York City	Columbia College	Red sandstone	Potsdam, New York.
	Trinity Church, 1846		Little Falls, New Jersey.
	United Bank building		East Longmeadow, Massachusetts.
	Broadway Bank building		Portland, Connecticut.
	Collegiate Reformed Church, 1872		Newark, New Jersey.
	Fulton National Bank building		Hummelstown, Pennsylvania.
	Dutch Reformed Church	Berea sandstone	Berea, Ohio.
	College of Surgeons	Buff Amherst sandstone	Amherst, Ohio.
Philadelphia, Pennsylvania	Saint Mark's Protestant Episcopal Church, 1849	Brownstone	Portland, Connecticut.
	Bank of North America, 1850	Brownstone	Portland, Connecticut.
	Young Men's Christian Association building, 1868	Buff Amherst sandstone	Amherst, Ohio.
Providence, Rhode Island	New Catholic Cathedral	Brownstone	Portland, Connecticut.
	Grace Church		Little Falls, New Jersey.
Salt Lake City, Utah	Mormon Tabernacle (piers)	Red sandstone	Red Butte, Utah.
San Francisco, California	Bank of California, 1865	Blue sandstone	Angel Island, California.
Santa Fe, New Mexico	Federal building	Cerrillos sandstone	Los Cerrillos, New Mexico.
Trenton, New Jersey	State Capitol		Trenton, New Jersey.
Washington, District of Columbia.	Smithsonian Institution, 1847 to 1856	Seneca sandstone	Seneca Creek, Maryland.
	United States Capitol, old portion, 1793		Aquia Creek, Virginia.
	Executive Mansion (painted)		Aquia Creek, Virginia.
	Treasury, old portion, 1836 to 1841		Aquia Creek, Virginia.

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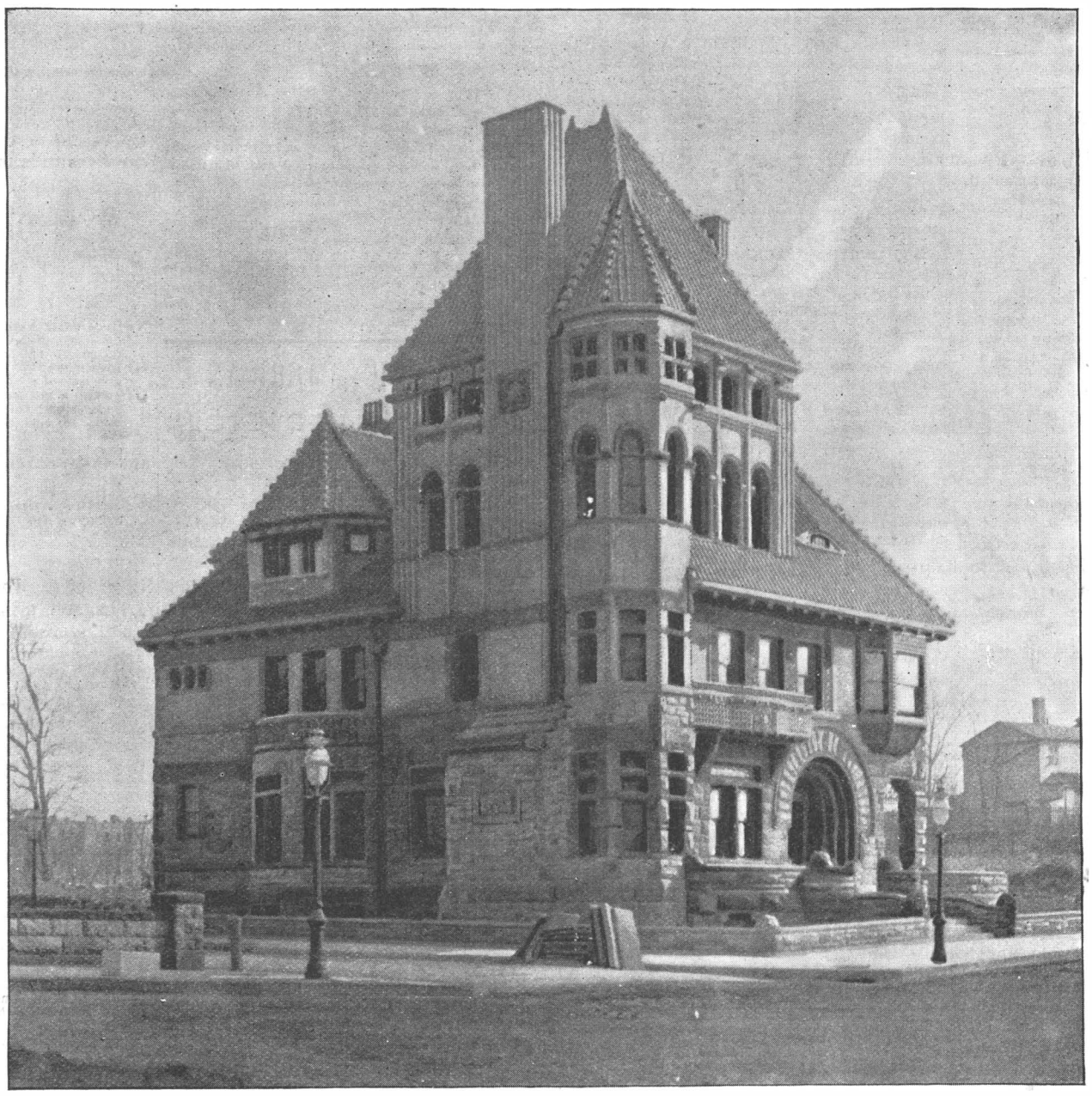
RESIDENCE ON RIVERSIDE PARK, NEW YORK.

We show in the accompanying engraving the residence recently erected for Mr. S. G. Bayne, at one of the most picturesque points of the Riverside drive. This building was erected from plans of the architect, Mr. Frank Freeman.

Its dimensions are: Front, 45 ft.; side, 60 ft. exclusive of piazza. Height of ceilings: Cellar, 7 ft.; basement, 8 ft. 6 in.; first story, 11 ft.; second, 10 ft.; third, 9 ft. Underpinning and first story of New Jersey stone, called gray rock, trimmed with Lake Superior red stone. Second story is built of brick, made of special color, by the Perth Amboy Terra Cotta Co., who also made the terra cotta which enriches the window openings, cornice, etc. Front entrance is flanked on either side with clustered columns, and is fitted up with broad, massive doors of quartered oak. Roof is covered with Spanish tiles. One of the striking features of the exterior is the "Romeo and Juliet" balcony at second story, front. The interior arrangements, while rivaling in magnificence the elaborate workmanship and composition of the exterior, is carried out in a style quite independent of conventional ideas. The most striking feature of the inside is the staircase and hall opening into a suite of apartments, a vista of which is obtained immediately upon entering. The first floor is handsomely trimmed with cherry, elaborately carved. The staircase is a grand one, with carved newels, and is lighted by a massive stained glass window. The first landing has seats and fireplace. Hall has a paneled wainscoting, finished with a carved cap. The ceilings in hall and library are heavily beamed and ribbed, forming deep panels, the centers of which are covered with canvas and painted in tapestry effect. A nook with seats, separated by columns and spindle work, and a large open fireplace with tiled hearth and carved mantels, are the features of parlor, while the dining room is finished in colonial style and wainscoted in panels. Buffet and mantel have colonial columns running from floor to ceiling, with carved capitals and numerous little cabinets with beaded glass doors, that add to the antique effect of this room. Butler's pantry and rear hall trimmed and wainscoted with antique oak, and are fitted up with drawers, cupboards, bowl, and dumbwaiter to kitchen, also a trunk elevator from cellar to third floor. Second floor is trimmed with sycamore, finished in cherry. Bath rooms are paved and wainscoted with Italian marble, and are finished in a most expensive manner. Third floor trimmed with antique oak; contains four bed rooms and bath. Billiard room is located in tower (fourth floor), and is fitted up in log cabin style, the walls and ceiling being covered with quartered oak. Basement, trimmed and wainscoted with antique oak, is provided with breakfast room, kitchen, laundry, pantries, servants' bed room, and bath, all furnished replete in all their various appointments. Cellar contains furnace and other apartments.



A RESIDENCE ON RIVERSIDE PARK, NEW YORK.

Our engraving was made direct from photographs of the building, taken specially for the Architects' and Builders' Edition of the SCIENTIFIC AMERICAN, to which we are indebted for the use of the cut and description. This was published in the June issue, which also contains a colored lithograph of the same building and full plans.

ONE of the items of revenue of the Brooklyn bridge is a yearly rental of $13,000 from telegraph and telephone companies, for allowing their cables to lie on the iron stringers.

The Science of Old Age.

The whole journey of life is best divided into three stages—the period of ascent or youth (1–25); that of level ground or maturity (25–50); and that of descent or decline (50–75). Old age may set in anywhere along the last stage. It must not, however, be supposed that the last stage necessarily ends at 75; for, of late years especially, in many cases the period of old age has not begun until 80 years are past, life being prolonged over the century; while, on the other hand, all the signs of old age have been seen before 20 years have been reached. Out of every 1,000 people, nearly 100 reach 75, 38 reach 85, and 2 reach 95. The number of persons in proportion to the whole population that reach 70 in Norway is one-third, in England nearly one-fifth, in France one-eighth, and in Ireland one eleventh. As far as can be calculated, the average length of life, which is computed in the seventeenth century to average only 13 years, is in the eighteenth increased to 20 and in the nineteenth to 36. Men used to be considered old when they passed 50.

It is interesting to compare the age of man with that of other parts of the organic kingdom. In the vegetable world it is enormously exceeded. Among trees, the elm reaches an age of 335 years; the ivy, 450; the chestnut, 600; the olive, 700; the cedar, 800; the oak, 1,500; the yew, 2,800; while Humboldt computed the age of a baobab tree (a species of banyan) to be 5,700 years! Among fish, Dr. Richardson finds no deaths from old age, and does not believe that they have any term to their lives, save as they fall a prey to one another. Carp and other fish that have been isolated and watched are still living at enormous ages. As long as they live they increase in size. Among animals, we have an elephant of the reputed age of 1,007 years. Coming to men, we find many remarkable instances of longevity. The long lists given by the old writers of very aged people (including one of over 300 years of age) have been proved to be most unreliable. Many cases, however, are beyond suspicion, and such an unimpeachable centenarian as Sir Moses Montefiore silences all skeptics who doubt that human life can attain to three figures. Old Parr still remains as one of the most wonderful of these veterans. He was a poor farm servant, and like Henry Jenkins (who was supposed to be 160 years old at death), led a hard and laborious life in a country village on scanty fare. At 120 Parr married a widow for his second wife, and at 130 could thrash corn. He died at 152, but not of old age.

Longevity appears to depend to a certain extent on country and climate. While a cold, bracing climate like Norway gives a very high general average of age, the climate of Western Italy seems most favorable to very advanced life. As early as A.D. 76 we find that in this district, in the emperor's census, 54 were returned at 100, 57 at 110, 2 at 125, 4 at 130, and 3 at 140. In Ireland, though the general average is low, we get many instances of centenarians. A country life is conducive to old age, while it is extremely rare to find persons of 90 years and upward who have led sedentary town lives. Longevity cannot be said, however, to be dependent on any condition or vocation, but is found in the most opposed circumstances. St. Anthony, who died at 105, ate a few ounces of bread soaked in water, never washed or changed his garments, and lived always alone in a desert. M. Chevreul, the great French chemist, at nearly the same age, ate for breakfast two eggs, some chicken pasty, and had a pint of *cafe-au-lait* daily; for dinner, tapioca soup with grated cheese, a cutlet, a bunch of grapes, cheese, and three glasses of water. No fish and no wine. He was scrupulously clean, and lived in or near Paris. Some people survive in spite of their habits. One old man of 97 all his life drank quantities of neat gin and smoked the strongest and rankest tobacco; while the Rev. W. Davis, who died in 1790 at 105, and who ought to have known better, for the last 35 years of his life never took exercise, and began the day on hot buttered rolls, and ended it with a supper of hot roast meat, with plenty of wine. Spinsters will be pleased to know that single women live as long as do married. Sex influences old age. In 1873, out of 89 dying at or over 100, only 10 were males. This is due partly to less exposures to injuries and partly to greater tenacity of life. Girls die more slowly than boys; and though more boys than girls are born each year, this difference maintains the balance.

We may notice one or two other points of comparison between the sexes, as observed in some hundreds of recorded cases lately collected. The average height of an old man over 80 is 5 feet 6 inches, of an old woman 5 feet 3 inches; the pulse rate in the man is 73, in the woman 78; the breath rate in the man 18, in the woman 22. The average number of teeth in the men is 6, in the women 3; while a fourth of the men and half the women had none at all. It is believed that there are traces in the animal kingdom of a law that fixes the extreme duration of life at five times that of growth. This latter period in man may be said to average 21 years. Hence the full span of a perfectly healthy man's life should range from 100 to 105 years. As, however, none are born perfectly free from taint, the expectation of life varies greatly. Every human being starts on his life's journey with a certain life-force; or, in other words, like a clock, he is constructed to run a certain time under given conditions. In 500 cases of people over 80, most came from long-lived families, enjoyed good homes, good appetites, and good digestions; were moderate or small eaters, consumed little alcohol or medicine, were good sleepers, and showed at death no trace of gout or rheumatic gout. Nevertheless, in 82 cases the near relatives were consumptive.—*New York Ledger.*

PARIS is laughing over a joke about an American inventor who is said to have patented an electric corset that is to bring about the reign of morality at once. If one of these articles is pressed by a lover's arm it at once emits a shriek like the whistle of a railway engine; and the inventor claims that he has already married three of his daughters, owing to the publicity thus thrust upon a backward lover.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ACTUATED VALVE. — Ila N. Moore, Battle Creek, Mich. By this invention the piston is provided with steam ports leading to the ends of the cylinder, and a valve is fitted to slide on the piston and control the ports and the steam inlet ports, the invention covering also certain parts and details designed to form an improved valve more specially adapted for use as motive power for steam pumps. The construction is simple and durable, and no steam chest is necessary for the operation of the device.

INSULATOR FOR MARINE CONDENSERS.—Peter Decker, Norwalk, Conn. A complete non-conductor of electricity is, by this invention, interposed between the adjacent portions of the exhaust steam pipe and the copper condensing tube, to prevent the rapid oxidation of the exposed iron portions of the propeller shaft, wheel and fittings, due largely to galvanic action from exposure to salt water of the copper tube forming the condenser and the iron parts. The invention covers a novel construction and combination of parts to make effective the introduction of an insulating joint by which the pipes may be connected in various ways, as may be desired in different engines.

Railway Appliances.

CAR COUPLING.—William Bentley, Lethbridge, Canada. This invention provides for a vibratory drawbar having a draught pin on its lower side that enters a slot in the drawhead, a transverse rocking lever loosely connected to the drawbar, a sliding latch bar moved by the drawhead, and a rock shaft which may be manipulated from the side of the car and is adapted to move the latch bar from below the rocking lever, with other novel features. It is a coupling of simple construction, and adapted to automatically couple cars of varying height, while the uncoupling may be effected from the sides or roof.

CAR COUPLING.—Edward P. Eastwick, Jr., New York City. Three patents have been granted this inventor, all relating to car couplers of the vertical plane type, and being improvements on two former patented inventions of the same inventor. The drawhead is provided with a virtually integral buffing plate or pin adapted to sustain the buffing strain of the knuckle, and which, if desired, may be made of harder metal than that of the drawhead. The pin or plate is also so located that a space will intervene between its side edges and the opposed faces of the drawhead shank, whereby the buffing plate or pin may be inserted when the drawhead is cast, and the head and shank be continuously and conveniently cored. The improved construction also provides for the ready removal of worn surfaces and injured bearings, and their renewal with perfect parts readily inserted in place, there being convenient means for uniting the tail bolt with and securing it in the shank of the drawhead. The line of draught and connections with the draught rigging of the car are also so arranged that when the knuckles of opposed drawbars are coupled they will be maintained in close engagement and subjected to a minimum of friction.

Mechanical Appliances.

VISE. — David F. Tallman, Lyme, N. H. This is a simple, strong and shapely device for wood or metal workers' use, and affords means to grip and hold a piece of work inclined forwardly at any desired angle, the vise and bench being also so made that the vise may be orbitally moved to throw the plane of the jaw faces at any desired angle to the front edge of the bench top, and be detachably secured when so swung, the alteration with regard to forward inclination of the jaws being permitted at any point of orbital adjustment.

VISE.—Charles Wies, Faulkton, South Dakota. This is an improvement in that class of vises in which a cam or eccentric is employed for clamping the sliding jaw, and the construction is such that when the lever is turned to a position over and in line with the tooth bar of the jaw, the jaw will be free to be moved by the hand forward or back. After the jaw has been adjusted to proper position the lever may be turned to either the right or left to tighten and clamp the jaws upon the object held. This vise is adapted for use as a right or left hand vise, and when any of the parts become worn or are broken they can be conveniently replaced at small cost.

ORE ROASTING DISH. — William F. Oden, Butte City, Montana. This invention relates to dishes such as used in an assayer's muffle, for roasting small quantities in assaying. The dish consists of a bowl with an annular inner rim, and bridges connecting this inner rim with an outer rim of the bowl, while the cover is formed like an inverted bowl and adapted to rest on the bridges. The construction is simple, and designed to prevent loss of ore in use, at the same time giving free access of air to the contents of the dish.

SEWING MACHINE.—Jerome T. Bowyer, Winfield, West Va. This invention relates to attachments readily applicable to various makes of sewing machines which have a lower shuttle, and which make a lock stitch, whereby the stitch may be changed to chain stitch when desired. The attachments are arranged in connection with operative parts of the machine, and are adapted to be quickly thrown into or out of operative position, thereby permitting either style of stitch to be made by the machine.

MEAT CHOPPING MACHINE.—William H. Ashton, Seward, Neb. The chopping block on which the meat is placed is caused to revolve by the operating of a shaft by a crank arm, the shaft at the same time operating a frame carrying a series of knives with curved cutting edges to give a rocking motion to the knife blades over the block, the rocking motion being controlled by friction rollers. The knife blades are thus made to rock over the revolving meat on the block, coming continually in contact with new portions until every part has been acted upon and the meat is thoroughly chopped.

Miscellaneous.

FAN MOTOR. — Isidor Silverstein and Morris Savelson, New York City. This is an attachment for a rocking chair, to be actuated by the rocking of the chair and move one or more fans conveniently located to fan the occupant of the chair, the device admitting of a close folding adjustment of its parts when not in service.

COLORING SHINGLES. — Joseph D. Horton and Frank S. Lee, Chicago, Ill. This is a device for coloring flat articles, and adapted to be located over a receptacle, consisting of two cover sections connected by adjustable hinges, with brushes secured to the cover sections, the working surfaces of the brushes extending beyond the edges of the cover sections practically to an engagement, providing a simple means whereby shingles, etc., may be conveniently and expeditiously treated without waste of coloring material.

FILTER. — Jacob A. Fulton, Astoria, Oregon. Combined with a casing having an inlet and outlet is a bag of wire gauze containing the filtering material, a canvas covering being arranged around the wire gauze shell, in the lower end of which is secured a ring, while a cover and bottom are arranged on the ends of the shell and each provided with a coarse wire netting and layers of fine wire gauze. The filter is economical of construction and easily cleaned, hot water being preferably used in washing out the impurities lodged in the bag.

LETTER BOX.—William Shempp, Williamsport, Pa. Combined with the letter opening of a door and a letter-receiving bag secured over such opening, is a box or frame in which a name holder is pivoted in bearings, a spring holder being arranged to actuate the name plate and secure the holder in bearings, while the upper side of the mouth of the bag is provided with a spring whereby it is held normally closed and may be expanded for the insertion of the hand. The device forms a combined door plate and letter receiver.

EXHIBITION RACK. — Henry A. Buchholz, New York City. This is a device for supporting a number of articles for display, as hats, etc., and capable of being folded up in a small space for storage in a sample trunk or other receptacle. It is designed as an improved article of manufacture consisting of end posts or uprights provided with apertured blocks and end and side rods pivotally connecting the blocks.

SHOE LACE FASTENER.—William Wellock, Salt Lake City, Utah. This is a simple and inexpensive device for securing the ends of shoe laces, the invention consisting in the peculiar construction and arrangement of the parts of a button or clasp made all in one piece and designed to be set in the leather of the shoe after the manner of an eyelet. The edge or periphery of the head of the fastener is designed to slightly bury in the lace at the point where the wraps cross, forming a detent that holds the lace against becoming unwrapped.

NECKTIE FASTENER.—Joseph Walter, New York City. This invention provides an improved button and clasp, the clasp being adapted for spring engagement with the head of a stud, such as a collar button, means being also provided whereby such buttons and clasps to be used in conjunction with them may be employed as fastening devices for articles of apparel.

BROOM. — Philip C. Newbaker, Danville, Pa. In this brush a broad elastic metal plate or spring is interposed between the brush or broom head and the handle to give elasticity to the broom, which may have splints of wire, fiber, or other suitable material. This plate is attached to the handle through a socket, the plate spreading out to a width at the bottom equal to that of the broom head, to which it is attached by opposite side flanges, being fastened to the wooden block or head by screws.

BUCKLE.—Ernest J. Neuville, London, England. This invention relates to buckles mainly used for fastening the back straps of garments, but also applicable to other straps presenting independent ends. It is adapted to lie flat, presenting no objectionable projections, and may be readily entirely detached. No button is needed on the strap, and the buckle has no prongs to puncture or tear the strap, the fastening being effected principally by movable pivoted gripping or clamping end limbs.

TEACHER'S CHART.—Arthur L. Gillis, Mount Pleasant, Iowa. This is a chart for teaching addition, the invention being an improvement on a former patented invention of the same inventor. It has a casing with upper and lower shutters, a main section with openings and intermediate dead spaces, the latter provided with numerals, and a series of vertically adjustable strips, provided with numbers of greater value in double rows, alternated by numbers of less value, for exposure through the openings in the main section. The chart affords convenience for a wide range of drill, the teacher closing the upper shutters for primary drill.

ADJUSTABLE HEARTH. — Joseph H. Bennett, St. Joseph, Mo. A vertically movable heat effluent box is adapted to discharge heat when elevated through a floor, and provide a hearth when its top is aligned with or is near the floor, there being mechanism for the vertical adjustment of the box, the preferred use being to distribute heat in rooms directly above a cellar or basement. The improvement is designed to serve the double purpose of a heat effluent in cold weather and afford a chimney hearth when the heat is not needed.

DISTILLING APPARATUS.—William P. Swartz, Telluride, Col. This is a simple apparatus, designed mainly for the use of druggists and chemists, for distilling water and other liquids. The boiler is preferably conical, and has a filling tube, while a stand pipe rising from the center of the boiler is surmounted by a water tank, in the center of which is a conical chamber with which the stand pipe communicates. As the vapor condenses in this conical chamber it flows off through a spout in its bottom. A flange or collar on the stand pipe protects the water tank from the heat of the boiler, and affords the means of holding up the apparatus by hand when a burner instead of a stove is employed in the distilling.

COATING FOR PILES, ETC.—Frederick E. Lampert, San Francisco, Cal. This is a compound to be applied to timber that is to be submerged, to preboring by the teredo and other worms, and to preserve the timber against water rot or decay. The compound consists of a mixture of coal tar, asphalt, oxide of copper, fish oil, oxalic acid, and salt, in certain proportions, and prepared and applied after a prescribed manner.

SCREEN.—William S. Pollitt, Walsenburg, Col. A simple and durable device, especially adapted for screening coal and delivering it to cars or other vehicles, is provided by this invention. The construction is such that the coal will pass slowly over the screens and be screened by laterally reciprocating the sieves, means being provided whereby any one of the screens or sieves may be removed and one of finer or coarser mesh be substituted.

ROPE HOLDER AND FASTENER.—Robert Osborne, Homestead, Pa. This invention provides a rope clamp consisting of a casting or stock having a rope passage through it and a pivoted cam or tongue, the lower end of which crosses the rope passage, while there is a rope guide in the form of a hook on the back of the cam or tongue, above its lower end. The plate or socket piece is designed to be fixedly secured by screws or otherwise to a post or building, the device forming a convenient means for holding and fastening awnings, clothes lines, etc.

PIANO PEDAL ATTACHMENT.—George C. A. Class, Philadelphia, Pa. This is an improvement on a former patented invention of the same inventor. The attachment is simple and durable in construction, and can be readily applied and adjusted to any desired height to accommodate persons of different stature in playing upon the instrument. The device also forms a foot rest for the performer to rest the feet upon while not using the pedals.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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BUILDING EDITION.

JULY NUMBER.—(No. 69.)

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3130) W. R. asks: What is the cause or the stain in the inclosed print? By holding it up to the light and looking through it, you will see that it has the appearance of an oil spot. I have had considerable trouble of this kind recently, and am at a loss to know how to avoid it. Have tried to be careful with my hypo. Is it the fault of silvering or carelessness in handling and due to hypo? How can I remedy the fault? The paper is "N. P. A. Dresden," silver bath, hydrometer test about 45. A. The trouble appears to be due to insufficient fixing of the print at the spots, caused probably by the face of one print coming in close contact and sticking to the print either above or below it. Try constantly moving the prints while fixing.

(3131) J. H. J. asks: 1. When receipts are given including parts both of liquids and solids, if not specified, should the liquids be weighed or measured? For instance, in answer to question 2673, it says 1 part nitrate of ammonia and 2 parts of water. A. By weight always, unless otherwise specified. 2. Can calcium chloride ($CaCl_2$) be used over and over again in drying gases, and what is the best way to fuse it? A. Yes. Heat it in an iron pan with frequent stirring. The heat need not be pushed to fusion. It may be used in the loosely granular condition in which it is left by stirring. 3. I have tried several times the experiment of showing the composition of water by synthesis, passing H over heated CuO, but have never been able to get exactly the result of 1:8 as it should be. What is the best way of doing it in order to get the true result? A. We can give no specific instructions beyond suggesting that the operation has to be conducted with great care and that a full degree of chemical skill or manipulation is requisite to obtain quantitative results.

(3132) E. E. K. asks for a receipt or preparation for frosting windows so they will look as they do just after a hard freeze, something that will crystallize and not come off by washing with water. A. A very simple preparation is to place a piece of putty in a rag, wrapping it tightly therein, and to "dab" the glass therewith. After the application has dried it may be varnished. A strong solution in water of sulphate of soda or of alum is often applied. This will not be waterproof unless varnished, and the latter will interfere with the effect. Photographer's ground glass varnish will give a flat, opaque surface.

(3133) F. J. F. asks: Please give me a receipt for hardening wood pulp, what chemicals are used, and how pickled for use, before being put in a mould to be pressed in different shapes and so that it will not stick to the mould when cold. A. Various substances can be used to harden the pulp, such as glue, starch and gum arabic, tragacanth, etc. The dry pulp should be mixed with as thin mucilage as is possible to make it stick together when pressed. White clay or kaolin can be also mixed with the pulp to make it like a putty. The moulds should be slightly oiled to keep from sticking.

(3134) F. H. writes: 1. I am thinking of making a collection of birds' eggs. What is the best mode for keeping them from spoiling? Can they be kept indefinitely after this mode has been used without

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any further trouble? A. The contents should be blown out just as you blow out a hen's egg. The shells will keep indefinitely. 2. What is the easiest and best way of preserving birds after they have been killed? How do persons get birds that are wanted for preservation? Does not shooting them injure the plumage a good deal? A. You will need the "Taxidermist's Manual," which gives full directions for preserving and setting up of natural history specimens. Price $2.50 mailed. It is a complete work for amateurs. 3. How do you account for worms so often seen in rain barrels after a storm? A. The worms were probably in the barrels before the storm and were only stirred up by the storm. 4. Will hair from a horse's tail change to a snake or to any other life form if placed in water? A. Horse hairs will not turn into snakes or other form of life.

(3135) M. S. S. asks: 1. Is there any way of taking the coating out of a copper tea kettle caused by boiling hard water? It is about ¼ of an inch in thickness and as hard as brick. A. If the deposit is calcium carbonate, it will dissolve with effervescence if muriatic acid, not too strong, is poured upon it. Quite a quantity may be required. If the deposit is calcium sulphate, you may very slowly dissolve it out by rain water, cold or hot. 2. How is rubber made into very thin sheets and forms, such as toy balloons, etc.? A. By slicing blocks of masticated rubber the sheets are made. They are then cut and stuck together with certain precautions, partly by natural cohesion, partly by the use of cement. For some notes as to the process we refer you to "Rubber Hand Stamps and the Manipulation of India Rubber," $1 by mail.

(3136) J. S. J. asks: Will you please explain in your query column why soda water used in cutting steel leaves so much smoother, brighter surface than oil? A. Because the soda water being more fluid than oil flows to the cutting edge of the tool and lubricates the cut. The soda as an alkali gives the water a greater affinity for the oily surface of both the tool and the steel, and causes it to flow between the point of contact of tool and metal. Its cooling power is also greater than that of oil, which can be seen by the heat carried off in vapor at the point of cutting.

(3137) C. A. G. asks how to produce a low temperature sufficient to keep meat and other perishable goods, also bottle liquids, at little expense. A. The cheapest and most practical way in this latitude to produce a low temperature, except on the large scale, is by proper use of ice.

(3138) T. P. A. asks: 1. Will the motor in "Experimental Science" work as well with a drum armature? A. Yes. 2. What size wire should I use on armature and field for 110 volt circuit, and what would be its back E. M. F. so wound? A. You should wind your armature and field magnet so that their combined resistance will be about 30 ohms. If this is a shunt machine, three-fourths of the resistance should be in the field magnet and one-fourth in the armature. If it is a series machine, the resistance of the armature and field magnet may be about equal. 3. I have made a simple motor, as described in "Experimental Science," illustrating the Gramme ring, but can only get it to run about 100 revolutions. Will more wire and stronger field increase its speed? A. Probably you can increase the speed of your experimental Gramme ring by placing more wire upon the armature. We think you do not need a stronger field. 4. In a catalogue the Edison-Lalande battery is advertised (one style) as giving 15 ampere hours with resistance of 0·025 ohm. How can I calculate the E. M. F.? A. Divide the ampere hours by the resistance, and the quotient will be the E. M. F., which in this case is 0.6 of a volt.

(3139) N. C. H. A.—Concrete wall such as you propose would make a good foundation for your barn. Use 1 part best cement and 3 parts clean sharp sand. You can figure the quantities from the above. For prices write to dealers.

(3140) W. B. H. asks: What difference in pressure exists in top and bottom of a five foot boiler at a pressure of 80 pounds? A. The difference in gauge pressure at top or bottom is due to the height of water in the boiler. If there is 4 feet of water in the boiler, the bottom will have nearly 2 pounds more pressure than the top.

(3141) B. G. asks how to make birch beer out of birch bark or root. A. Take birch bark ½ pound, hop ½ pound, allspice ¼ pound. Boil in a few gallons of water for a few minutes. Mix with enough water to make 10 gallons, when below 100° Fah. add one pint of yeast. Allow it to ferment.

(3142) J. D. T. asks for the most simple and convenient way of fastening platinum tips to the copper wire of a cautery electrode such as is used in surgical operations, in which a white heat is necessary. A. Silver solder would undoubtedly make the best connection, but galvanic soldering with copper or even a screw clamp will answer.

(3143) E. C. K. writes: I have a five gallon nickel plating solution which has lately been giving very inferior results. I have decided to renew the bath and would like to know if you could inform me how to recover the nickel from the solution? A. Prepare a saturated solution of sulphate of ammonium. Add with constant stirring to the bath and let it stand. After a while a granular deposit of the double nickel ammonium sulphate will appear. If the supernatant liquid is colorless, the precipitation is complete. Otherwise add more of the ammonium sulphate. When complete precipitation has been obtained, pour off the liquid, drain the precipitate and redissolve for the new bath.

(3144) F. W. asks for a recipe for making soda foam that is used in milk shake. A. Take four pounds gum arabic in lumps of best quality, pour over it four pints of boiling water, and stir from time to time until dissolved. Strain through flannel if necessary. One or two pints of simple sirup may be added to help it to keep. One or two ounces to the gallon of sirup will answer for soda with sirup. For milk shake add in same proportions to the milk. Add one-half grain of calomel as a preservative.

(3145) J. H. A.—Your question as to whether *Syzigium jambolanum* is the correct name of the plant to which you refer cannot be definitely answered until botanists tire of classifying plants each according to his own idea. The other names you give are synonyms of the above. We have not been able to find any other information in regard to the use of the plant in diabetes than that given in the SCIENTIFIC AMERICAN of October, 1888.

(3146) B. P. J. B. asks: Please give me receipt for making a white ink with which to mark on dark goods, such as umbrellas, black clothing, etc. A. Mix pure freshly precipitated barium sulphate or "flake white" with water containing enough gum water to prevent the immediate settling of the substance. Starch or magnesium carbonate may be used in a similar way. They must be reduced to impalpable powders.

(3147) W. R. B. asks how to remove ink from newspapers a couple of weeks printed, something that will not destroy print on back of the paper. A. Use javelle water or a solution of oxalic acid and tartaric acid in water. No bleaching agent affects printer's ink, but all ordinary writing inks yield to some of them.

(3148) G. E. asks: How many volts and amperes will it require to heat to cherry redness a piece of steel 12 inches long by 1¼ inches wide and one-twentieth inch thick? Of course the quality will make a difference. Please give me as close an approximate as you can. A. Taking the temperature at 1,500° Fah., a current of 565 amperes should suffice, maintained by a difference of potential of 0·07 volt; 30,000 amperes suffice to weld a pair of 1 inch copper round bars.

NEW BOOKS AND PUBLICATIONS.

TAXIDERMY AND ZOOLOGICAL COLLECTIONS. A complete handbook for the amateur taxidermist, collector, osteologist, museum builder, sportsman, and traveler. By William T. Hornaday. With chapters on collecting and preserving insects. By W. J. Holland. New York: Charles Scribner's Sons. 1891. Pp. xix, 362. Price $2.50.

In this large and handsomely printed and illustrated book it seems as if taxidermy and its allied branches of the natural historian's work have at last been adequately dealt with. The subject is treated *ab initio*; it begins with the hunting of the animals and study of fresh specimens, and extends down to the final preservation of skins and mounting the same, and treatment of the stuffed and mounted objects. The entire field is covered, egg collecting and preservation, the making of casts, osteology, or the preparation and mounting of skeletons, and insect collecting and mounting are side branches that receive full treatment. Taxidermy proper fills the second part of the work, which includes some 158 pages. The subject is here given in full detail, with many practical hints from the author's own experience. Beginning with mammals, the subject of birds and crustaceans comes next, with final chapters on grouping, and even painting museum specimens. Insect pests, the collector's great enemy, are described, and methods of killing them are given. A bibliography of books of reference and a full index close the work.

THE ENGINEERING MAGAZINE. Published by the *Engineering Magazine* Company. World Building, New York. Monthly, 25 cents per copy, $3 per year.

There is no better proof of the general interest that is being taken at the present time by the general reader, by business men, and farmers in scientific and engineering works than the fact that new journals and periodicals are constantly being established. A knowledge of engineering, of electricity, and mechanics is now considered one of the necessary concomitants of ordinary education. The *Engineering Magazine* is the latest addition to this class of literature. It is the same size as *Scribner's* or the *Century*, and is handsomely printed and is fully illustrated. The general character of the magazine may be judged from the subjects treated of, which include war ships of the U. S. Navy, a survey in a diving suit, the development of the South, healthful air in factory buildings, iron and steel industries in America, etc. There is also a department of architecture, electricity, mining, and mechanics.

COLOR MEASUREMENT AND MIXTURE. By Captain W. De W. Abney. London: Society for Promoting Christian Knowledge. New York: E. & J. B. Young. 1891. Pp. 207. Price $1.

The well known author of this volume states that about ten years ago he began to work upon three measurements of the spectrum—the heating effect, the luminosity, and the chemical effect. The task thus set is completed, and in this attractively printed and well illustrated volume of the "Romance of Science" series we have presented in popular form the results of Captain Abney's work. The analysis of color and light by rotating disks is described, and the ingenuity shown by the writer, who was assisted by General Festing, is very evident. We commend the work to all interested in this field of physical science.

THE MAKING OF FLOWERS. By the Rev. Prof. George Henslows. (Publishers as above.) Pp. 168. Price $1.

The "Romance of Science" series receives a notable addition in the present work. The anatomy of flowers and the meaning and function of their different parts, the specialization of flowers, and the many branches of this part of botany, are admirably treated by the well known author. His contention is that flowers have been moulded into their present forms by the agency of insect visitors, that their formation is an act of evolution, and he appears himself as a pronounced evolutionist.

COAL AND WHAT WE GET FROM IT. By Raphael Meldola. (Publishers as above.) Pp. 210. Price $1.

The presentation of an account of the great industries based on coal, including the manufacture of gas, coke, and coal tar products, is the object of this work. The author in very limited compass presents a *resume* of a vast collection of topics, and is obliged of course to treat them rather superficially. Yet the subjects seem very nicely treated and to be well put. A chronological summary of some of the chapters is an exceedingly convenient and valuable feature.

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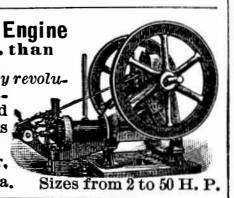

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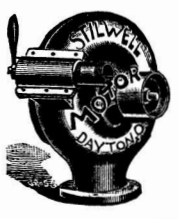

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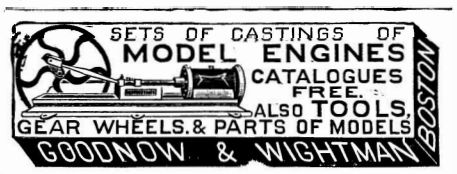

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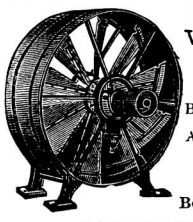

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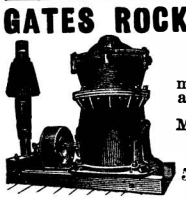

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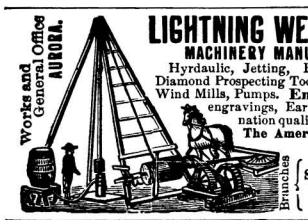

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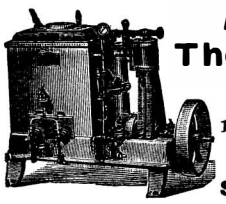

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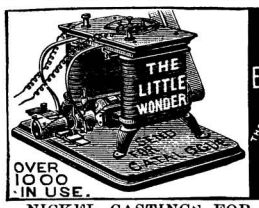

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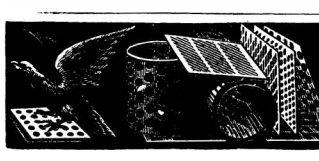
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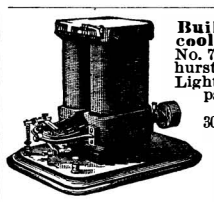

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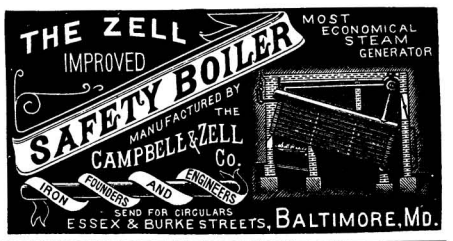

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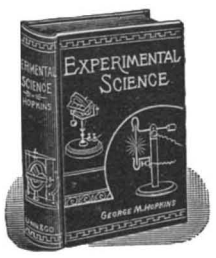

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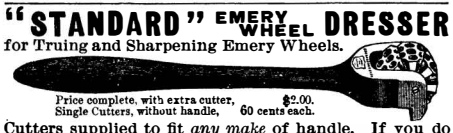

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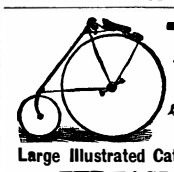

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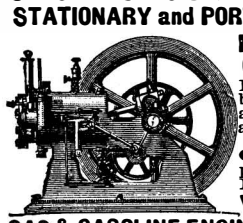

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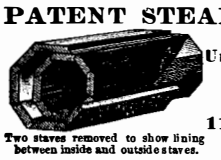

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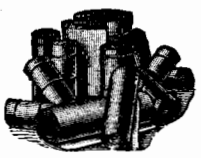

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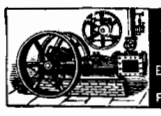

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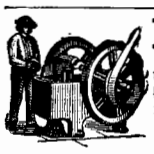

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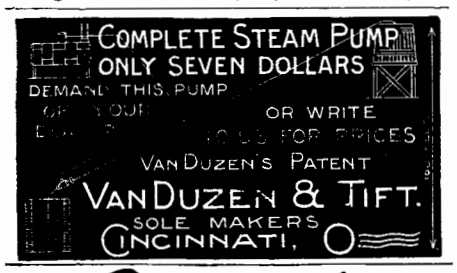

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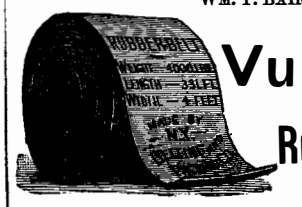

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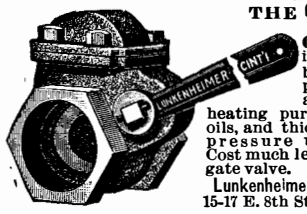

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